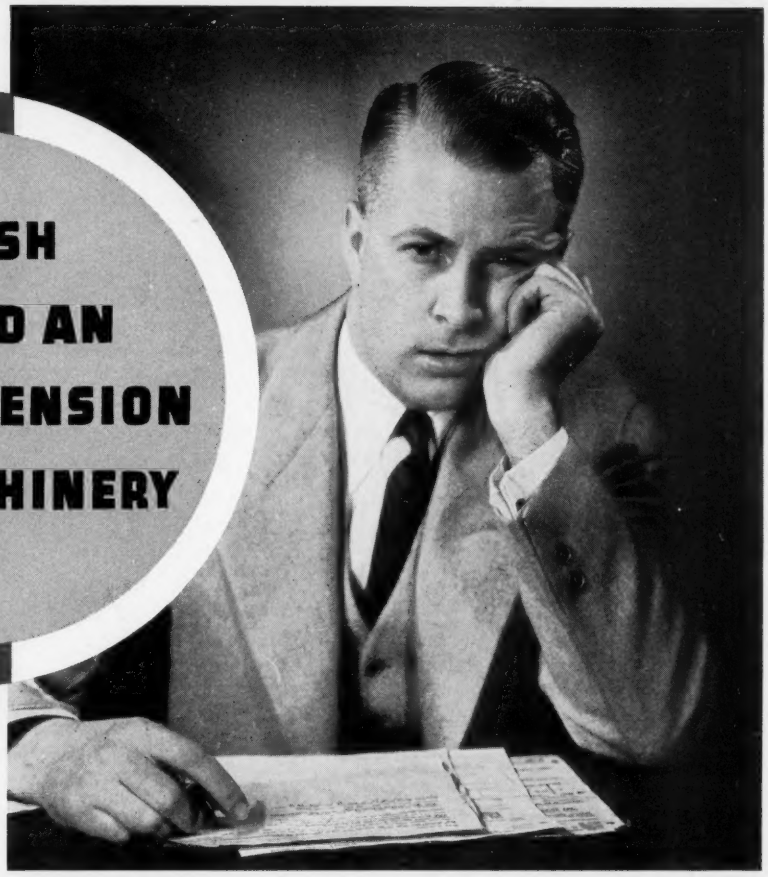
WIRE AND WIRE PRODUCTS

MARCH 1935

"I WISH WE HAD AN OLD-AGE PENSION FOR MACHINERY"



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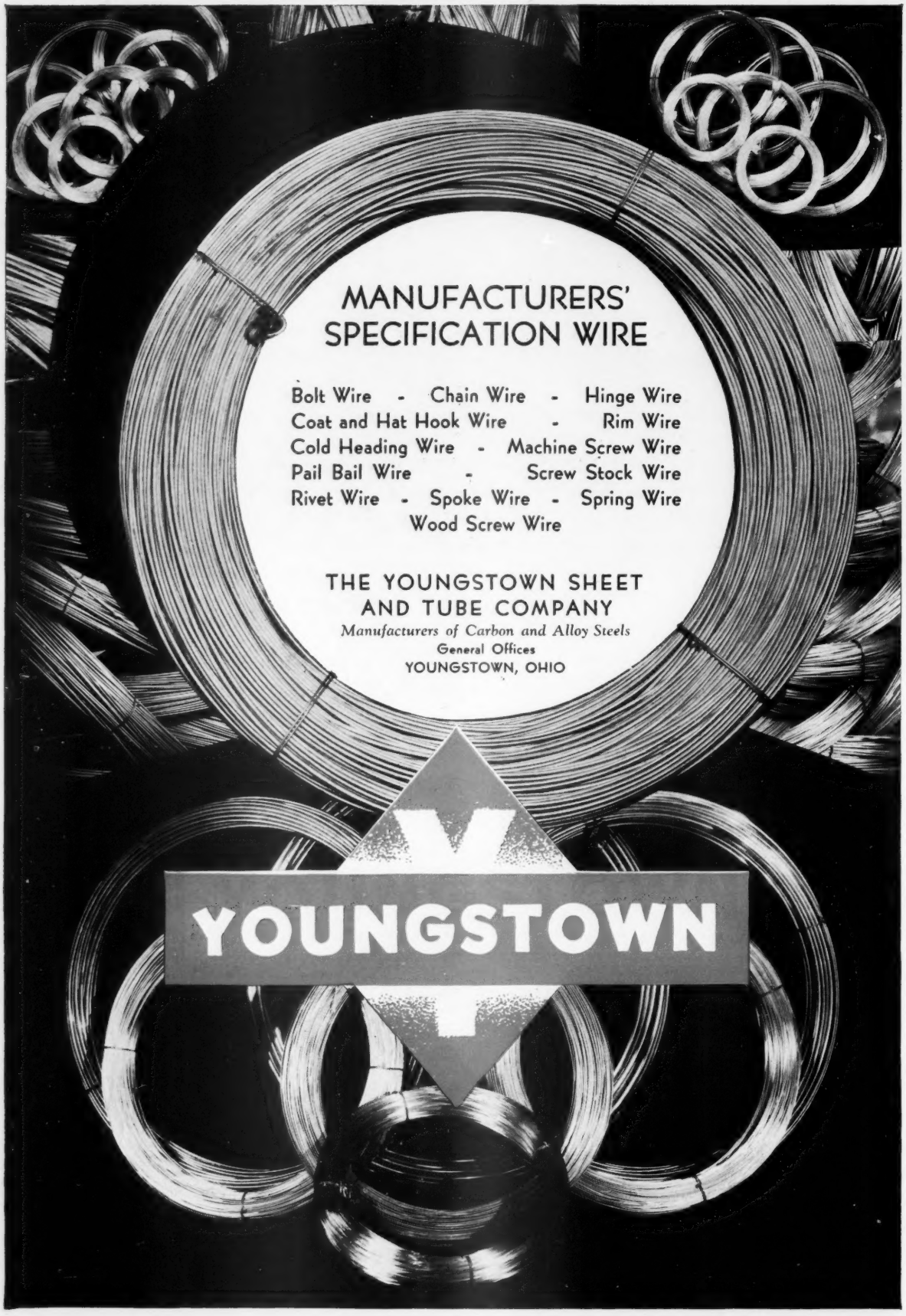
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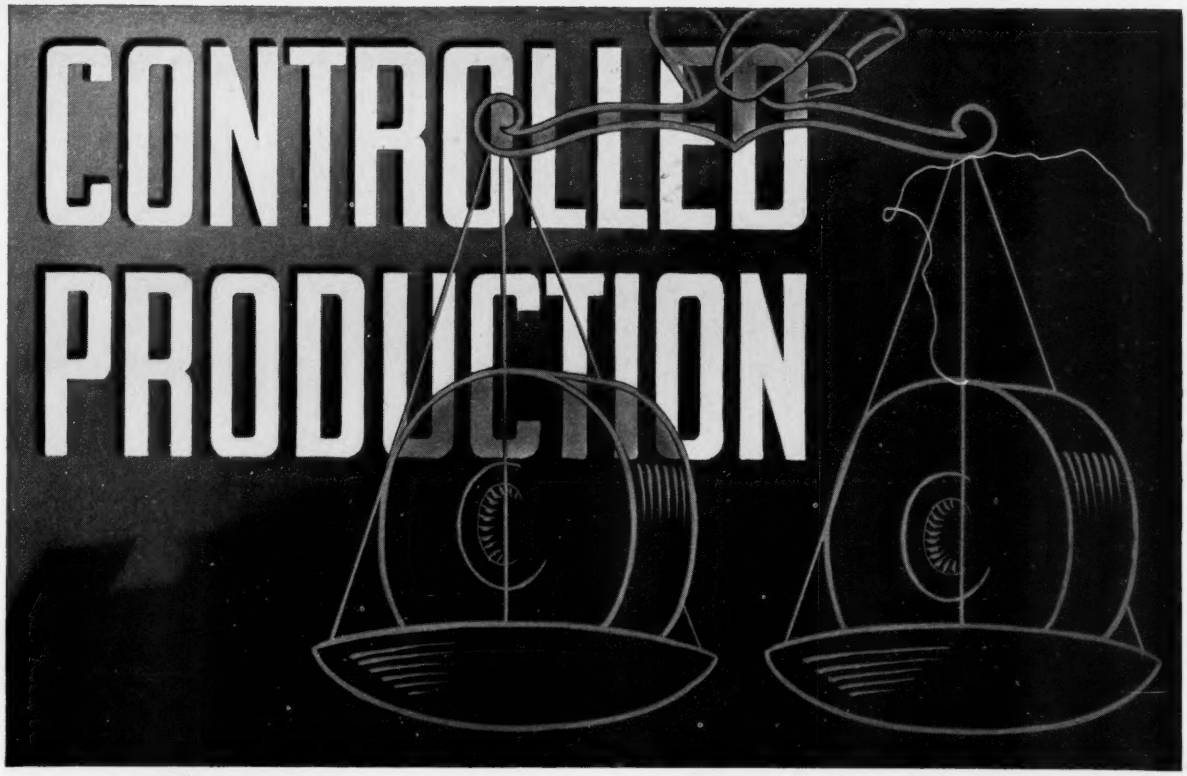

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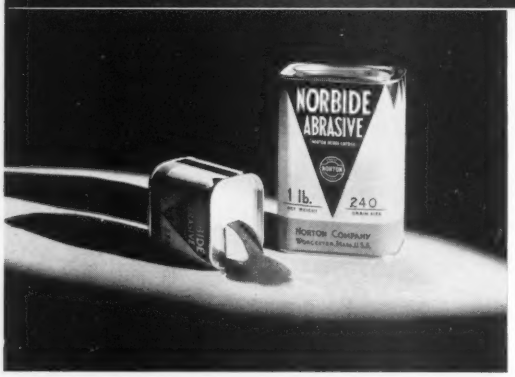

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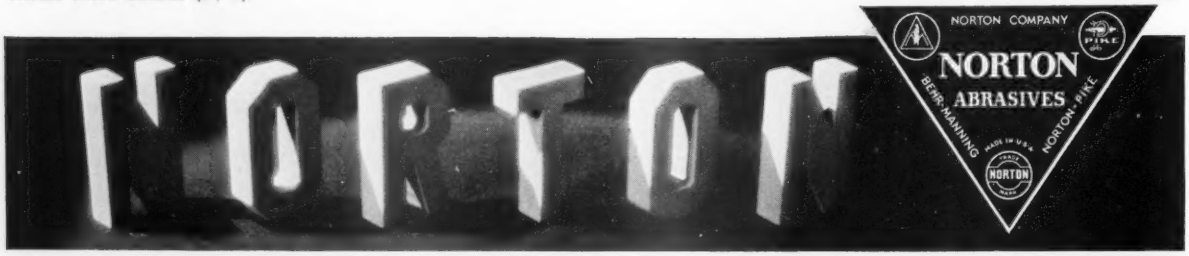

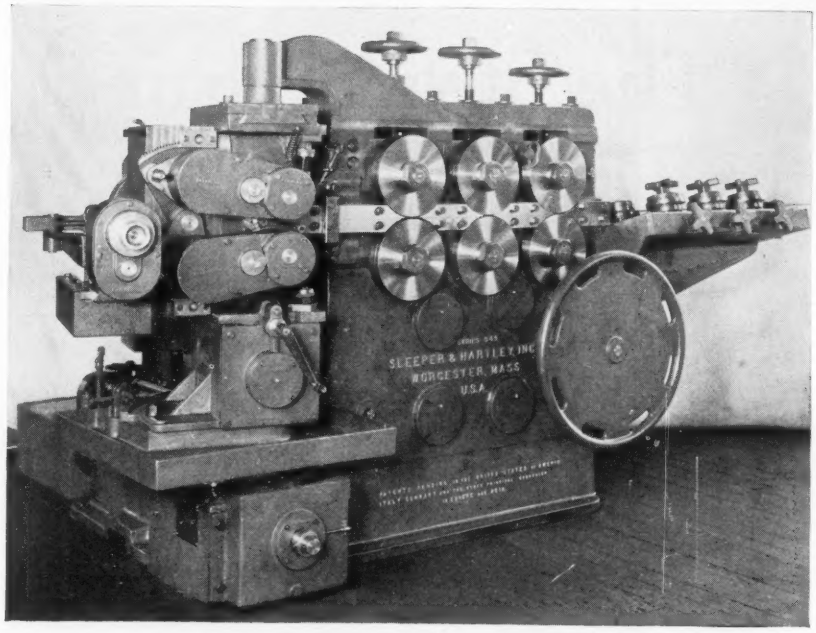

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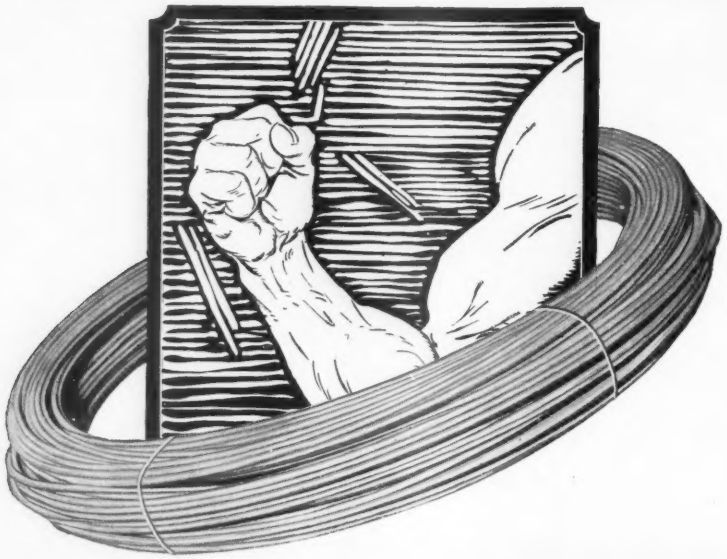

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A monthly publication devoted to the production of Wire, Rod and Strip, Wire Products and Insulated Wire and Cable.

DRAWING—ROLLING—EXTRUDING—FORMING—FABRICATING

Vol. 10 March 1935 No. 3

Designated as

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A monthly publication devoted to the production of Wire, Rod and Strip.
Wire Products and Insulated Wire and Cable.
DRAWING --- ROLLING--- EXTRUDING --- FORMING --- FABRICATING

Vol. 10 March 1935 No. 3

Stranding of Conductors

By Jack Delmonte

Electrical Engineer, Naval Aircraft Factory, Philadelphia, Pa.

A study of the stranding of conductors in connection with the development of cables to comply with the specifications of the naval aircraft factory.

THE stranding of conductors offers the advantage of greater flexibility in a cable than experienced with solid conductors. On bending conductors of the same size, one stranded and the other solid, the section of the solid conductor on the outside of the bending radius suffers large tensile stresses as illustrated in figure 1. These stresses manifest themselves in a force component toward the center of the bending radius, which places the innermost section of the conductor under compressive stresses, as illustrated. On attempting the same bend with a stranded conductor, a slight displacement and parting of the individual wires occur to alleviate the stresses upon the outermost wires (with reference to the bending radius). The greater the number of strands, the more possible is the alleviation of these stresses and the greater the flexibility.

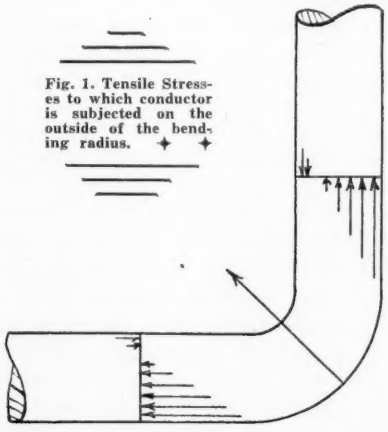


Fig. 1. Tensile Stresses to which conductor is subjected on the outside of the bending radius. ✦ ✦

✦ ✦ ✦

ONE of the most general and widely used methods of stranding the conductor utilizes one wire as the central core and the other wires concentrically stranded about it. The successive layers are helically wound, the direction of the winding (lay) being alternated for each layer. Figure 2 enables a better visualization of the cross-section of the conductor and the successive layers of wires. Assuming a uniform gage for the stranding wires, the number of wires in the successive layers are calculated as follows:

Allow D = diameter of the central wire; then 2 D equals the diameter of the centers of the wires in the first layer; 4 D equals the diameter of the centers of the wires in the second layer; 6 D equals the diameter of the wires in the third layer, etc.

The corresponding circumferences are 2 πD, 4 πD, 6 πD, etc.

The number of wires in the suc-

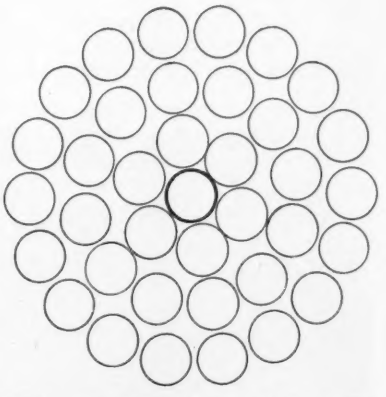


Fig. 2. Cross Section of the conductor and the successive layers of wires. ✦ ✦ ✦

Designated as Official Publication by the Wire Association

cessive layers are equal to the circumference divided by the diameter of one wire, or 6, 12, 18 etc.

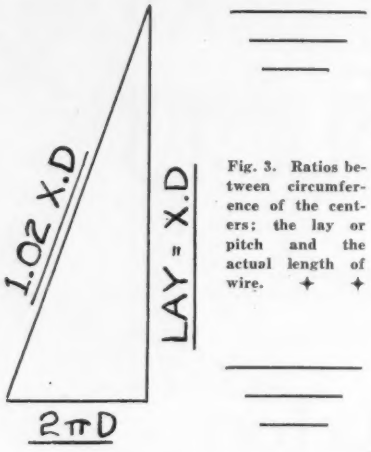


Fig. 3. Ratios between circumference of the centers; the lay or pitch and the actual length of wire. ✦ ✦

IN helically coiling the stranding wires, there is a greater length of wire due to their lay than measured parallel to the axis. The lay or pitch is the distance (measured axially) for a wire to wind completely about the periphery serving as a base. It is believed to be a good practice to allow the stranding wires a certain increase in length, and then calculate the lay required for this increase. A right angle triangle (see figure 3) depicts the ratios between the circumference of the centers of the stranding wire (2 πD for the first layer); the lay or pitch (expressed in diameters of individual wires); and the actual length of wire (expressed as an increase over the lay—2% in this example). The problem is to solve for X, which by simple trigonometry is approximately 30. Table I gives the lay **expressed in diameters of individual wires** for successive layers, for a 2% increase in length of stranding wire and for a 1% increase in length of stranding wire.

✦ ✦ ✦

TO account for the increase of length due to stranding wires the value of electrical resistance for a given gage or given circular mils area of a stranded conductor must be increased. The following simple formula, based upon a 2% increase in length due to the stranding, gives the resistance of the stranded conductor at twenty degrees Centigrade.

$$R = .883 \frac{l}{m}$$

TABLE I

No. of Layer	Wires Per Layer	Length Lay (2% increase)	Length Lay (1% increase)
First	6	30	44
Second	12	60	88
Third	18	90	132
Fourth	24	120	176
Fifth	30	150	220

where l—length of conductor in inches
m—area of stranded conductor in circular mils.

✦ ✦ ✦

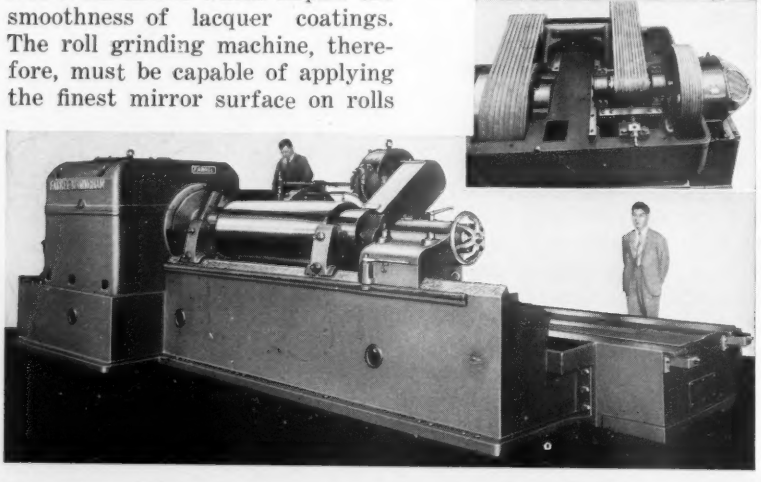
STRANDED conductors are widely used in commercial applications and a simple working knowledge of the stranding practices is of value.

New Roll Grinder Drive Eliminates Roll Marking

THE major requirement of the modern roll grinding machine is the combination of accuracy, finish and speed. Metal strip and sheet for many purposes, such as automobile bodies, refrigerator cabinets, furniture, etc., must be rolled with a high finish and be free from marks which impair the smoothness of lacquer coatings. The roll grinding machine, therefore, must be capable of applying the finest mirror surface on rolls for rolling high finish sheets. It must be equally capable of taking heavy cuts for rough grinding and of refinishing rolls with the required accuracy and finish in the shortest possible time.

✦ ✦ ✦

TO eliminate the vibrations inherent in even the most accurate and carefully mounted gear-driven headstocks, with consequent marking of rolls, requiring much time and trouble to remove, the 36″ x 12′ 0″ Farrel Heavy Duty Roll Grinder shown in the accompanying illustration is built with a multiple V-belt drive for rotating the rolls. The performance of several of these machines so equipped has proven conclusively that a much better finish is obtained in a shorter time. In one steel mill rolls that formerly required five to six hours are now being finished in two hours with a perfect surface free from marks of any kind. In this mill they are getting results in improved quality of output and increased grinder capacity that they had thought could never be attained on any roll grinder.



✦ ✦ ✦

THE headstock drive on this 36″ machine is self-contained in one cast iron case mounted directly on the front bed. Three reductions, all of which are multiple "V" belt drives, reduce the speed of the 300/1200 R. P. M. motor to

(*Please turn to page 124*)

The Story of Wire

By Captain Frank W. Bullock

Signal Corps, U. S. Army

A survey of the origin and development of the wire industry, together with an analysis of the conditions creating wire products markets and a ten-year forecast on the future of the wire industry. An original research prepared for the Harvard Graduate School of Business Administration. Part II.

Wire Rod Production

IT has frequently been asserted that the apparent backwardness of the art of wire making is largely attributable to the limitations in the raw materials from which wire is made. The term raw materials, if considered in its generic sense, tends to make the above statement misleading. The statement must, however, be taken in its technical sense, in which case raw materials mean wire rods, of any basic material.

✦ ✦ ✦

AT the time when the first crude wire mills appeared in America, iron rods were produced either by hand hammering or sheared from plates either by hand or on crude slitting mills. The resulting rods seldom exceeded six feet in length, and were not only very rough but of uneven size, varying from 2 to 7 pounds in weight. They were drawn straight, down to a size approximating the present day 16 B. & S. gauge. The number of drafts was five or six times the present practice and annealing was necessary every two or three passes. Fine wire was drawn on hand operated winding blocks, with little change or improvement until well into the nineteenth century. Wire making was essentially a household industry in America; there was no commercial demand for heavy wire, and coils of wire of from 2 to 7 pounds, the limit possible from the only rods available, were well within the physical limitations of hand working. There was therefore no incentive for improvement in wire drawing.

✦ ✦ ✦

SOME years prior to the War for American Independence a growing demand for heavier wire in longer length began to make itself felt in the Colonies. Cotton planters in the South discovered that wire was superior to fiber for bale ties, and the spinners and weavers of New England demanded wire in steadily increasing quantities. American wire makers, as a result of the inhibition against the export of machinery from England, were dependent upon European sources for practically all of their raw materials. It was but natural, therefore, that the earliest attempts to improve the methods of making wire rods and the rods themselves were undertaken in Europe.

✦ ✦ ✦

A FRENCH ironmaster named **Fleuer** is credited with being the first man of sufficient imagination to conceive of wire production as anything bigger than a handicraft, and to undertake a serious scientific study of wire making technique. In 1728 **Fleuer** prepared a schematic production layout for his idea of a wire mill, complete with time studies and calculations. As a result of his work he became convinced that any improvement in wire making must begin in the raw material. This conclusion led to the revolutionary assertion that wire rods might be rolled instead of forged, that rolled rods could be made in such lengths as to make it practicable to draw them directly on large, power driven winding blocks, and that handling in process was the most important single factor in limiting production. Such ideas seemed little short of blasphemous to the ironmasters of that day; nobody would listen to him, indeed, he was suspected of practicing black magic. At least three generations ahead of his time, in the face of indifference and even opposition, he made progress. He succeeded in forging an oval rod which he passed through a pair of grooved rolls. In four passes he was able to produce a round rod approximately 5/16 inches in diameter, long enough for direct drawing on the winding block. This idea increased the rod and wire production per man more than tenfold over the best performance of the time.

✦ ✦ ✦

FLEUER'S experiments were a tremendous advance in the art of wire making, but the industry was reluctant, then as now, to accept new ideas. We learn that in 1769 a patent was granted in England to a **Mr. Ford** (no apparent relation to Henry) covering a rod mill consisting of several pairs of rolls coupled together. His patent application describes the looping of the rod between passes, not very different from present day practice. There is, however, no record of his mill ever being built. The wire mills of Ford's day still relied on hammered bars as the chief source of their material. Even the more familiar slit rods were used only by the bolder spirits in the craft, and received the hearty condemnation of the more conservative ironmasters. It is apparent therefore, that these revolutionary improvements in the art produced no corresponding revolution in the industry. The industry of a hundred and fifty years ago was characterized by a powerful inertia which resisted every change. The

industry today is characterized by no less reactionary tendencies.

✦ ✦ ✦

THE foregoing sketch of the historical background of the story of wire has been presented somewhat in detail with a very definite purpose. In most manufacturing industries, commercial development has followed technological discovery. The progress of the art has almost invariably preceded the development of markets, and in many instances scientific discoveries have led to the development of entirely new uses and markets for products. In the wire industry the reverse has been true. Every advance in the art of wire making has come in response to a definite commercial demand, and every improvement in product or process was made to satisfy a recognized and insistent human need. Historical details, perhaps irrelevant in themselves, have been recited to illustrate this peculiarity of the wire industry, which has a profound bearing upon the present position of the industry in the United States, and upon its future both here and in the markets of the world.

✦ ✦ ✦

The Wire Industry in America Today

AS Americans, viewing with pardonable pride the growth of our industrial civilization, we must realize that our forefathers, in establishing their first village industries, undertook no simple or easy task. To keep this study within reasonable bounds it is necessary that we jump over the first hundred and fifty years of our country's history. The real beginning of the American wire industry in a commercial sense, came in the year 1775. In that year, **Nathaniel Miles** built a wire drawing mill at Norwich, Connecticut, for which purpose he was granted a loan of fifteen hundred dollars by the General Court of that colony. It is with that date, therefore, that the modern "story of wire" begins.

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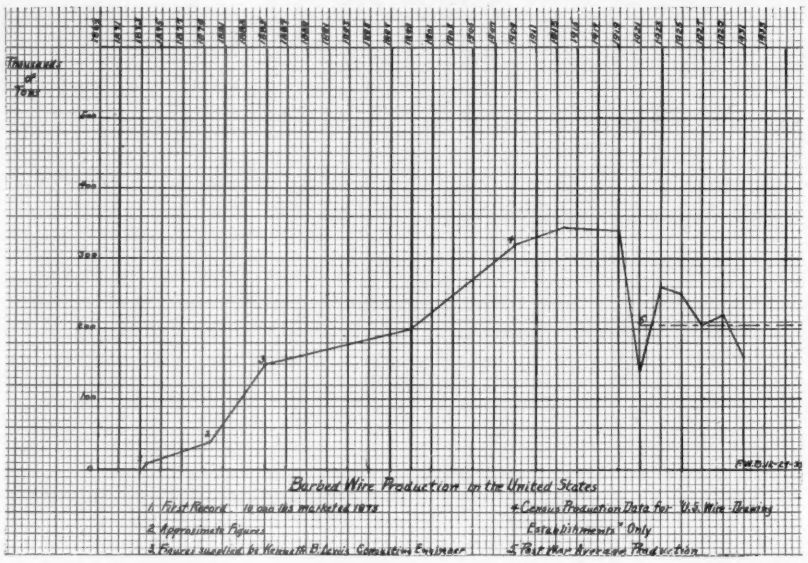
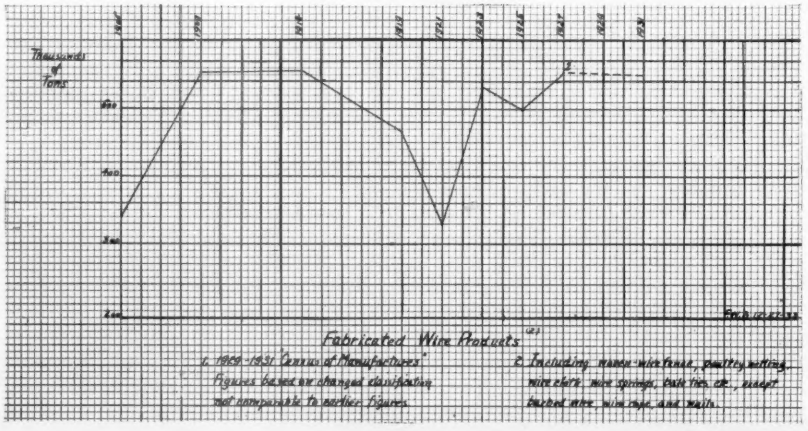
TO present a comprehensive picture of the wire industry as it exists in America today, is an undertaking which presents many peculiar and perhaps insoluble difficulties. As has been suggested, wire drawing and fabrication is a craft rather than an industry. Its technological development responds to rather than creates commercial demand. From the beginning in this country, wire making has been closely integrated, first with the iron and steel industry, then with the copper and non-ferrous alloys industry, and now with the electrical, public utility and communications industries. As a result of this integration only a relatively insignificant portion of the products of the wire industry are marketed as wire and strictly wire products. On the other hand wire and wire products marketed as such, appear in over eight hundred different commercial classifications.

CHART NO. 1


Thousands of Tons
Barbed Wire Production in the United States
1. First Record. It was the market in 1873
2. Approximate Figures
3. Figures supplied by Kenneth B. Lewis, Consulting Engineer
4. Census Production Data for "U.S. Wire Drawing Establishments" Only
5. Post War Average Production

THIS peculiar condition in the wire industry is reflected in the published statistics concerning it. Not only is statistical information deplorably meager and lacking in continuity but the figures gathered by the Government and by trade associations adhere to nothing even approaching a uniform classification. Then too, such quantitative figures as do exist are invariably expressed in tonnage, a unit which as a yardstick for the measurement of the growth of the industry or as an index of the productive capacity of the physical plant at any given time is entirely useless and misleading. The truth of this rather startling assertion becomes apparent when we consider that several of the largest manufacturers of wire market

CHART NO. 2


Thousands of Tons
Fabricated Wire Products
1. 1929-1931 "Census of Manufactures" Figures based on changed classification and not comparable to earlier figures.
2. Including round wire fence, poultry netting, wire cloth, wire springs, cotton ties, etc., except barbed wire, wire rope and welds.

none of their product directly and that a very substantial percentage of the wire actually marketed is produced in mills so small that they never find their way into census figures. In addition it is worthy of note that the output of a given mill expressed in gross tons conveys no idea of the size of the mill or the character of its equipment. Many of the most important and valuable items of wire and wire products appear negligible when expressed in tonnage, and the most complicated and costly processes produce the least product when so measured.

✦ ✦ ✦

THE temptation is therefore great to abandon any attempt to present a statistical picture of the wire industry as it is today and to tell the story of wire in terms of the part it has played in building our American civilization and in the personalities it has given to our industrial community. Unfortunately, to tell the story in that manner is not only impracticable, but the result would be of little interest to anyone not connected with the industry. There remains one alternative; the selection of certain series describing articles or products which may be classed as typical, which disclose recognizable trends and may furnish some basis upon which to estimate the present position of the industry and forecast its immediate future.

✦ ✦ ✦

IN selecting samples for consideration we turn instinctively to certain events, perhaps better expressed as steps in the material development of our country which profoundly affected the wire industry. For example, the tremendous expansion of the industry which began in 1847 came in a large measure as a response to the commercial development of the electric telegraph. We know that the extension of the telegraph was hampered by the lack of suitable wire. The short lengths produced at that time made line construction slow and costly and made service unreliable. The urgent need was for better finished coarse wire in heavier bundles, which in turn forced rod manufacturers to produce longer and better rods. To the spread of population westward, with its ever increasing demand for faster and cheaper housing construction, the wire industry responded with the wire nail. The pressure of traffic in our eastern cities called for bigger and better bridges. The response of the wire industry was wire rope, which immediately spread into other fields of service, such as mining, the oil fields, streets railways, and skyscrapers. The opening up of the prairies to agriculture brought barbed wire. The industrial and domestic application of electric power, the telephone, the radio, and the post war development of high tension electrical transmission brought revolutionary changes and expansion of the wire industry. The telephone alone is responsible for the latest and perhaps the greatest single expansion in wire making capacity.

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Diversity of Application -- Product Changes

TO the wire industry, in common with all other industries in this country, the past four years have been years of struggle and uncertainty. For the wire industry they have also been years of change. Old markets have vanished, while insistent demands for new products, for new uses, have become apparent. A shrinkage in total volume and value of output exceeding in severity the 1920-21 collapse has been accompanied by revolutionary changes in products and production methods. One of the speakers at the recent meeting of the Wire Association summarized the situation in the wire industry, as follows: "Large tonnage output, by mass production methods ended in 1930. Specialized methods producing better wire, in smaller quantities and at lower prices is the present problem of the wire industry. 1929 will never return and only those mills which can adjust themselves to new requirements and new conditions may hope to survive."[1]

✦ ✦ ✦

1 The Wire Drawing Industry (K. B. Lewis—Address delivered 1930).

THE factual basis for the above conclusion is not far to seek. During the past ten years, agriculture has turned upon itself, the spread into new territory has been succeeded by mechanization and intensive methods of cultivation. There has been a net shrinkage of acreage under cultivation not only in the industrial east, but in the prairie states as well. In the mountain states large grazing areas have passed under public control, the pioneer west has become civilized. The "cattle king" has become a farmer, the "nester" now goes in for dairy products and fancy poultry in place of wheat. With the passing of the wild and woolly west, has passed the barbed wire fences. Chart 1 illustrates not a temporary flurry produced by the depression, but a permanent change in demand which only a major war will revive.

✦ ✦ ✦

THE construction boom which reached its somewhat shaky peak in 1929 has fallen to a virtual replacement basis. Oil well drilling and operation have been subjected to drastic public control. These changes have been reflected in the demand for wire rope (Chart 3-B) and in nails (Chart 4) where material reductions in volume of production are in all probability permanent. The shrinkage of these large tonnage requirements has been reflected in a definite downward trend in the production of wire rods (Chart 5) which is certain to continue for some time to come. Due to the diversity of uses to which it is applied, the falling off in the output of plain iron and steel wire (Chart 3-A) is probably the effect of the general business depression and may to a large measure be regarded as temporary.

✦ ✦ ✦

COMPARED to these large tonnage wire products, the depression showing of special fabricated wire products (Chart 2) presents an interesting contrast and reflects the demand for new products to satisfy new requirements. For example, woven wire fencing and poultry netting are displacing barbed wire, flat wire and cold drawn shapes are displacing ex-

pensive forgings in many fabricated products. As a result of changes in automotive design, cold drawn coil springs are displacing forged leaf springs. The development of electric welding has created entirely new demands for welding wires. Improvements in electrical equipment have brought new requirements in non-ferrous wires, and improved metallurgy has made possible the application of cold working processes to new metals and opened up new fields for the application of cold worked products.

✦ ✦ ✦

Commercial Importance -- Productive Capacity

THE measurement of the commercial importance of an industry in comparison with another industry or with industry as a whole, implies the existence of some unit of measurement or denominator common to the several industries under consideration. When we attempt to measure the commercial importance of the wire industry in the United States and to estimate the position of American wire makers in world trade we discover that the essential common denominator is lacking. The familiar yardsticks of physical volume of output, market value of output, capital investment in plant, labor statistics and what have you, do not fit the wire industry. Why? First, because the largest wire producers in America are the steel mills of which "Bethlehem" and "American Steel and Wire" are examples. Statistics concerning these plants give no clue to the value of plant investment actually devoted to the making of wire. Turning to the producers of non ferrous wires we find the largest producers market directly relatively small percentages of their total output. For example, the Fort Wayne, Indiana, plant of the General Electric Company draws and insulates non-ferrous wires of a variety of types but sells very little, most of its output being absorbed in interplant transfers, through which it reaches the market in the form of motors, generators, transformers, etc. Or take if you please, concerns like "General Cable" and "Anaconda Wire and Cable"; they draw wire in enormous quantities but fabricate most of it into various commercial products so that it becomes impossible to measure the value added to the primary products by manufacture. Taking another example, how would one determine the money value of the wire component of a Western Electric switchboard or a Ford car? And would such valuation give any clue to the commercial importance of the wire industry?

CHART NO. 3

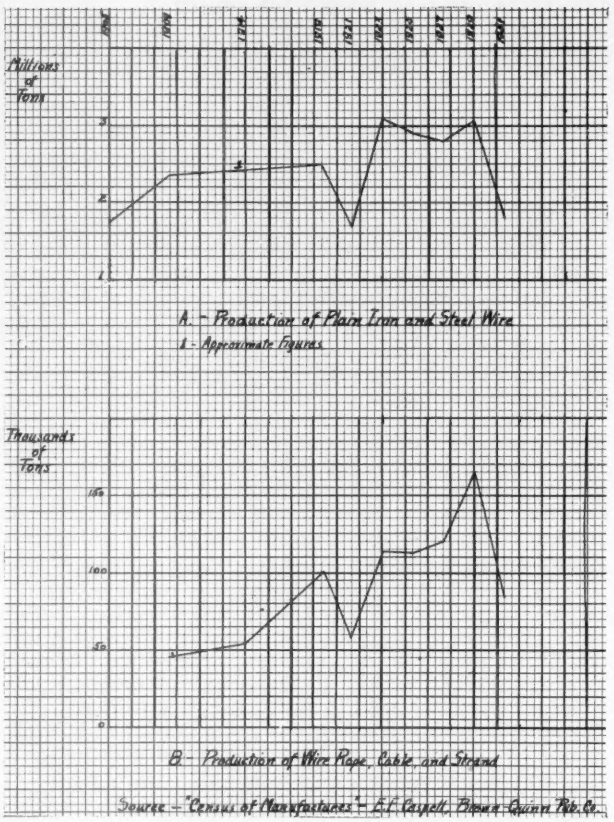
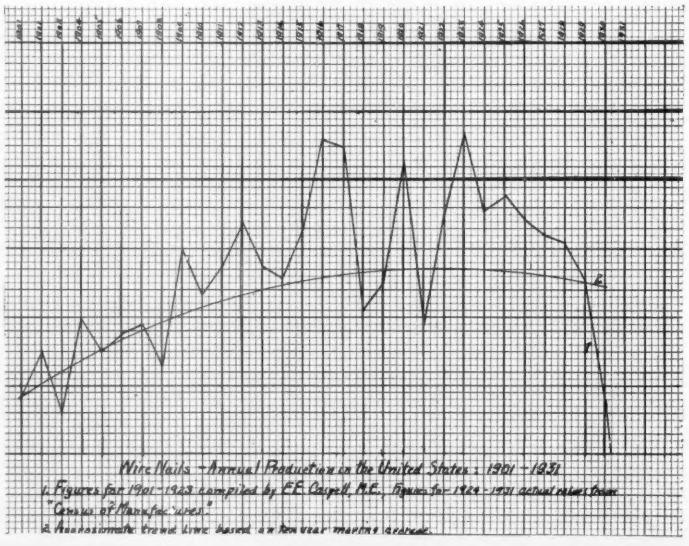

Millions of Tons
A. - Production of Plain Iron and Steel Wire
1 - Approximate Figures
Thousands of Tons
B. - Production of Wire Rope, Cable and Strand
Source - "Census of Manufactures" - E.E. Cassell, Brown Quinn Pub. Co.

CHART NO. 4


Wire Nails - Annual Production in the United States: 1901 - 1931
1. Figures for 1901 - 1923 compiled by E.E. Cassell, M.E. Figures for 1924 - 1931 actual returns from "Census of Manufactures"
2. Approximate trend line based on ten year moving average

Difficulties in Measuring Plant Capacity

WHEN we attempt to measure plant capacity we meet similar and perhaps even more serious difficulties. A machine or a series of machines may have a readily determinable capacity when measured in terms of one product or one unit of product, which becomes entirely false when expressed in another product or unit. For instance, a five head multiple drawing machine might produce 20 tons of number 10, low carbon fence wire in a day, employing one man. The same machine drawing high carbon music wire would probably show a day's output or less than four pounds. One ton of No. 5 wire rod can be drawn into a .012 inch telephone conductor long enough to connect Boston with Mexico City. The capacity of a mill drawing instrument wire valued in dollars per foot cannot be compared to that of a mill producing wire nails worth fifty dollars per ton. Eight hundred different commercial classes of wire furnish a poor index to plant capacity—and they only represent a small part of the picture. The job tickets of one mill less than an hour's drive from this school, covered 344 different products in a single month, and that mill draws nothing but high carbon steel.

✦ ✦ ✦

IT is apparent therefore that neither the commercial importance of the wire industry nor the productive capacity of its physical plant can be expressed statistically. To present any sort of a quantitative picture we must again resort to samples, realizing that the best possible selection of series will not furnish directly comparable figures. The series selected, however, disclose certain individual trends from which without too great a strain upon the imagination, the reader may construct a fairly accurate picture of the wire industry "as is". Exhibit 6, Tables 1, 2, and 3 showing average wage earners, connected horse-power, and approximate value of products, furnish a rough comparison of American manufacturing industry as a whole, with wire drawing and wire fabrication. Although admittedly rough and inaccurate it is interesting to observe how closely the movements of the values shown conform to the movements of selected products as charted in Exhibits 1 to 5. We note the sudden and important expansion which came with the opening up of the west in the closing years of the nineteenth century, followed by a period of relative stabilization, the rapid fluctuations of the war period and the slump of 1921. Most important of all, the figures reflect the shift in demand from simple, low cost, mass production items to the more specialized fabricated wire products of lower bulk and higher value.

✦ ✦ ✦

MEASURED quantitatively, it would appear that the wire industry occupies a rather insignificant position in the industrial community. On the other hand it has been well said that today the whole world is wired, and when we consider a few everyday facts it is not difficult to believe that this assertion is literally true. Let me

CHART NO. 5

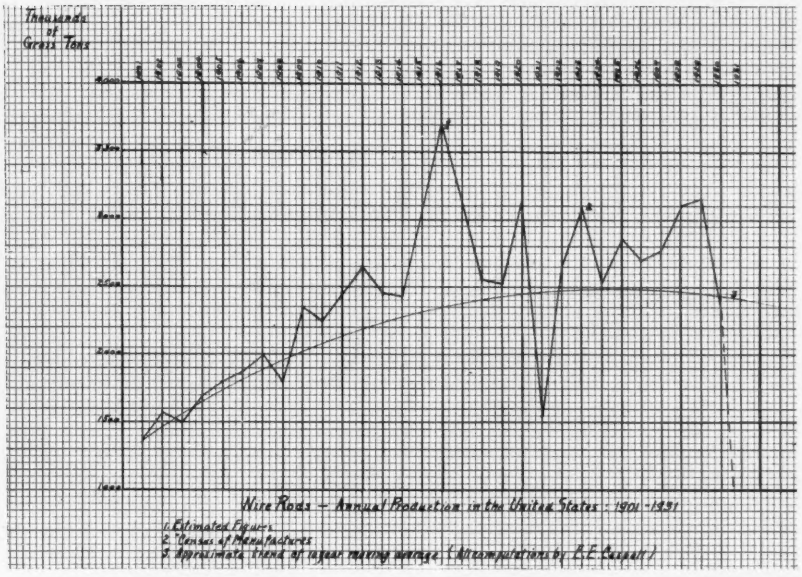

Thousands of Gross Tons
Wire Rods – Annual Production in the United States: 1901-1931
1. Estimated Figures
2. Census of Manufactures
3. Approximate trend of 4 year moving average (Computations by L.E. Gregory)

EXHIBIT 6
Relative Importance of Wire and Wirework Industries in the United States: 1899 to 1930.

TABLE 1
AVERAGE NUMBER OF WAGE EARNERS

Year or Period	Manufactures in Continental United States	Wire Industry	Wirework not elsewhere Classified
1899	4,712,763	1,603	9,142
1904	5,468,383	4,737	13,379
1909	6,615,046	18,084	12,348
1914	7,036,247	17,600	12,126
1919	9,000,059	19,741	15,138
1921	6,946,570	14,832	11,485
1923	8,778,156	21,310	16,783
1925	8,384,261	18,544	19,268
1927	8,349,755	19,866	21,697
1929	8,838,743	22,462	22,388
	PER CENT OF INCREASE		
1899-1929	87.5	1426.	245.2

Sources: Census Monograph VIII, page 147, Table 32.
Census of Manufacturers, U. S. Dept. of Commerce, 1929-31
(Compilation by "Wire and Wire Products", Vol. 7, 1932).

uniform wire

MEANS UNIFORM PRODUCTS

Manufacturers of wire articles of every kind find by experience that the use of Republic Wire means greater uniformity of product, increased production, lowered losses and increased saleability of the product through higher quality. These advantages result from the uniform gauge and temper, freedom from defects and the better finish that marks all Republic Wire.

A variety of grades makes it easy to suit the wire to the product, including—Manufacturers Wire, Basic Open Hearth or Bessemer, Annealed, Regular and Hard Drawn; Spring Wire; Coppered Wire, either Basic or Bessemer; and Cold Heading Wire in carbon and alloy analyses.

Where rust-resistance is a necessary quality, Enduro Stainless Steel or Toncan Iron Wire can be supplied.

Republic Wire has changed buying habits of many years' standing through a demonstration of its dependable uniformity. Complete information on any grade on request.

Republic Steel

CORPORATION

CHICAGO · · · ILLINOIS

GENERAL OFFICES · · · YOUNGSTOWN, OHIO

EXHIBIT 6

TABLE 2

CONNECTED HORSEPOWER

Year or Period	Manufactures in Continental United States	Wire Industry	Wirework not elsewhere Classified
1899	10,097,893	9,979	12,772
1904	13,487,707	25,856	18,280
1909	18,675,376	71,759	20,131
1914	22,437,072	83,940	21,547
1919	29,327,669	119,301	29,036
1921 (1)			
1923	33,094,228	123,923	31,617
1925	35,772,628	138,115	35,943
1927	38,825,681	152,574	45,858
1929	42,931,061	(1)	(1)
PERCENTAGE OF INCREASE—1899 to 1927 (1929—comparable figures not available)			
1899-1927	330.	1530.2	361.

Source: See Table 1. Add: Table 33, Census Monograph VIII World Almanac, 1932, page 370.

EXHIBIT 6

TABLE 3

Values of Products (Approximate—Thousands of Dollars (1) 1869 to 1929

Year	Manufactures in Continental United States	Wire Industry	Wirework not elsewhere Classified
1869	3,385,860	5,058	2,959
1879	5,369,579	10,837	9,128
1889	9,372,379	22,013	15,553
1899	11,406,927	9,421	19,840
1904	14,993,903	37,914	33,038
1909	20,672,052	84,478	41,938
1914	24,246,435	81,841	41,789
1919	62,041,795	162,151	90,225
1921	43,653,283	99,946	66,385
1923	60,555,998	196,364	100,248
1925	62,713,713	184,463	115,429
1927	62,718,347	190,710	128,536
1929	70,434,863	213,997	146,805

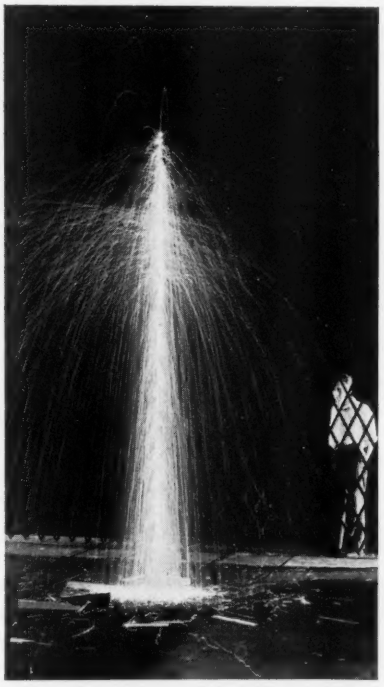
(1) Figures not weighted to standard dollar value.

Sources: Data compiled from Census of Manufactures, 1921 to 1929. Earlier data compiled from various sources by Kenneth B. Lewis and E. E. Caspell, (Wire & Wire Products).

illustrate. The single item representing the largest proportion of the output of the steel industry is wire rods. In absolute volume, wire rods rank a close second to the composite group loosely classified as "merchant shapes", and have displaced the one time leader, steel rails. Based on 1927 figures of the total output of copper refineries in the United States, 52.5 per cent was in the form of wire bars. Of the total copper consumed in this country in the same year 47.8 per cent was in the form of wire and wire products. Of the nonferrous alloys, 28.6 per cent was drawn into wire. The telephone and telegraph network in the United States represents an installation of 1,750,000,000 pounds of wire. The distribution circuits of the Bell System in Continental United States total in excess of 34 million miles, and when we remember that telephone cables run from ten to three thousand five hundred circuits each, it may be seen that the wire mileage figures become almost astronomical in magnitude. And these are but a few of the many places where wire fits into our economic and social structure. Figures and charts fail to carry conviction, they prove or disprove nothing, the very diversity of products of the wire industry and the uses these products serve, is proof enough that the wire industry occupies a position of tremendous economic importance.

✦ ✦ ✦

Part III of this article will be published in the April issue of Wire & Wire Products.



Industrial Shower

THIS cascade of molten metal particles was created in General Electric's high-voltage engineering laboratory at Pittsfield, Mass., when a 10-foot length of resistance wire was struck by a charge of "man-made" lightning. An electrical worker watches the shower from behind a safety gate.

✦ ✦ ✦

Electric Lamp Production up 24,000,000 in 1934

A TOTAL of 380,000,000 electric lamps were manufactured and sold in 1934 as reported by Ward Harrison, director of the incandescent lamp department of the General Electric Company. This was 24,000,000 above the total for 1919 which was the highest previous year.

Patenting Temperatures

By Kenneth B. Lewis

Consulting Wire Mill Engineer, Worcester, Mass.

This digest from a recent book on wire manufacture seems to be an excellent summation of the soundest of contemporary views on this controversial subject. ✦ ✦ ✦ ✦ ✦

THE sorbitizing of steel wire which we call patenting interests us from many angles, first perhaps by reason of the astonishing degree of ductility it gives to steel, then for the unusual way in which temperature is manipulated; we are dealing with a preliminary heating to an abnormally high temperature for an abnormally short time, then with a quenching of medium speed which is suddenly interrupted at a temperature higher than that commonly used to "draw" or temper a quenched steel. How about these abnormalities? Granted that they work out in practise, can they be defended on the theoretical side?

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MANY authorities have undertaken to answer this question. While they are not in agreement at all points they do agree pretty generally that the improvement resulting from patenting wire rod is attributable to the development of a large grain, and that therefore the high temperature is justifiable. This is in spite of the opinion generally held that the finer the grain in a quenched and tempered steel article, and the less it has been heated above the Ac_3 point, the better the job.

✦ ✦ ✦

THE matter begins to clear up a little upon examination of work done by Foley, Clayton and Rummer, and published in February 1926 in the Transactions of the American Mining and Metallurgical Engineers, on impact value of .50 carbon steels quenched and tempered. These authors found that while samples of such a steel quenched in water and tempered at 570 (300 C.) showed a decreasing resilience as the quenching temperature was raised, two other series of samples of the same steel when quenched in water and tempered higher, 840° to 1240° (450° to 675° C.), gave better and better tests as the quenching temperature rose.

✦ ✦ ✦

THIS result was a surprise to them. They could not attribute it to accident since the metal appeared to be absolutely normal in all other respects, and they concluded that the increase in resilience secured through this unusual quench and temper technique was the consequence of a homogenizing of the solid solution and a grain growth above Ac_3.

✦ ✦ ✦

THE authors added that in their experiment the speed of cooling did not exceed 110° to 150° C. a second. Since a speed of 220° a second is required to transform such a steel completely to martensite a certain amount of troostite or troostitic sorbite would have formed during the process, in a diminishing amount as the quenching temperature was pushed higher (acording to the researches of Portevin and Garvin). Microscopic examination showed the troostite but could of course give no information as to grain size in the solid solution at the same time of the quench.

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THE point to be noted is that the temperature and cooling speeds involved in the experiments just described are of the same order as those with which we deal in the patenting of wire, though the cooling was not interrupted and there was a subsequent tempering in lead. The improvement in the properties of the steel seems to be chargeable to the same underlying cause as that which affects patented wire, but the cause is as yet obscure.

✦ ✦ ✦

CERTAIN authorities have expressed the opinion that the improvement caused by this treatment is in consequence of the homogeneity which it gives the steel. We do not consider this explanation adequate. It is hard to see

Quenched at			Tempered at			Foot-pounds
Min.	F.	C.	Min.	F.	C.	
10	1550	845	30	840	450	8.25
10	1780	975	30	840	450	11.18
10	1850	1040	30	840	450	10.75
10	1550	845	10	1240	675	13.19
10	1780	975	10	1240	675	26.04
10	1850	1040	10	1240	675	25.44

why a patented structure should be any more homogeneous than one resulting from a quench and temper. Moreover, homogeneity does not appear to be the dominant factor in ductility. If one compares a mild steel, a medium steel, and a eutectoid steel, all normalized, one sees that their ductility is of a decreasing order as the carbon mounts, and yet upon examination at moderate magnifications the .40 carbon is clearly the most heterogeneous in structure. And again, it certainly has not been shown that patenting confers more ductility upon a eutectoid than upon a hypo-eutectoid steel which is most assuredly less homogeneous.

✦ ✦ ✦

IT is our opinion that the dominant factors in ductility are the amount, the form, and the distribution of the carbides. Ferrite is ductile by nature, and the brittleness of normalized steels after drawing increases with their carbon content. The dutility of a steel of given composition may be promoted by securing the best possible distribution of carbon in the least objectionable form. We shall see that patenting is the best known means to secure these ends.

✦ ✦ ✦

CARPENTER and Robertson have shown that when a hypo-eutectoid solid solution of gamma iron cools at a moderate rate the deposition of ferrite is very dependent on the maximum temperature from which cooling started. (Jour. Iron and Steel Inst., 1933, 1, p. 259 to 285). Since the ferrite deposits at the grain boundaries of the solid solution, the larger the initial austenite grains the less ferrite will deposit at a given cooling rate. The homogeneity of the structure will, therefore, increase with the increase in temperature and duration of the heating, and of the two temperature will be of greater influence. This is the real explanation of the value of a high temperature in patenting; its primary object is not to get a coarse grain in the product but rather to secure a homogeneous alpha phase. As a matter of fact a coarse gamma grain can transform into a fine alpha grain, as the gamma/alpha transformation generally starts at many points in the grain simultaneously.

✦ ✦ ✦

ASSUMING the carbon to be uniformly dispersed throughout the steel, in what state has it the best ductility; fine grained sorbite, or coarser grained massive pearlite, finely laminated troostite or coarsely laminated normal pearlite?

✦ ✦ ✦

IT is well known that when one wishes maximum softness he tries to get granular massive pearlite; these large rigid grains are quite all right for moderate deformations but they do not lend themselves to the heavy deformation which wire drawing involves. The fine granular structure obtained by tempering a quenched steel to martensite has the disadvantage of hardness of the sort explained by the well known theory of JEFFRIES and ARCHER which has found so many applications in recent years to the hardening of alloys with one constituent whose solubility varies with temperature.

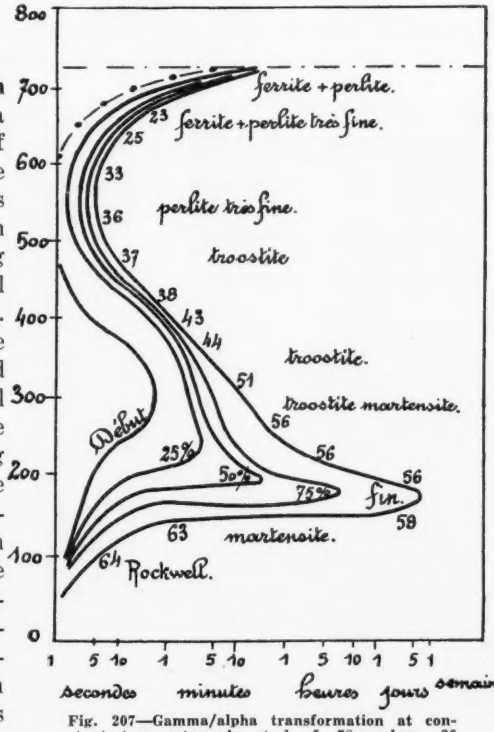


Fig. 207—Gamma/alpha transformation at constant temperature in steel of .78 carbon, .36 manganese, .16 silicon. (Davenport and Bain).

✦ ✦ ✦

THE form in which cementite most readily submits to severe deformation is beyond any question that of extremely thin plates which make up the troostitic sorbite structure resulting from a moderately rapid quench in air or in lead. HOWE and LEVY have pointed out the great flexibility of the lamellae of cementite in fine pearlite (Trans. Am. Inst. Min. Eng., 1914, p. 542). The thinner these plates the more easily they may be deformed. When it is recalled that elastic deformation by bending varies inversely with the cube of the thickness it seems quite logical to chose, in preference to pearlite, the much finer structure of sorbite which results from a direct quench in a lead bath of suitable temperature.

✦ ✦ ✦

FOR an understanding of what takes place during the very brief interval of time during which the wire is in the lead bath one may turn to the work of DAVENPORT and BAIN on the time required for the gamma/alpha transformation at constant temperature as a function of that temperature (Am. Inst. Min. and Metall. Eng., Tech. Pub. No. 348, 1930). These authors have followed, by many concordant methods, the progress of the transformation from austenite to the constituents of the alpha phase, at different temperatures and in different types of steel. Fig. 207 shows the result of their researches into a steel of the following compositions:

Carbon	.78
Manganese	.36
Silicon	.16
Sulphur	.048
Phosphorus	.036

✦ ✦ ✦

THE curves of this graph show the time required for the transformation of 25, 50, 75 and 100% of the austenite. They

(*Please turn to page 117*)

A New Wire Drawing Device For Use In Combination With Cold Headers

Drawing wire and manufacturing belts, cap screws, hinge pins, caster pins and other products in continuous combined operations with a wire drawer that is attached to a cold heading machine, and which draws and coats the wire and feeds it into the header intermittently as it is needed. ✦ ✦ ✦

THIS new machine or attachment is known as the Ajax-Hogue Wire Drawer. It is a recent development by The Ajax Machine Co., of Cleveland, Ohio. It is now in commercial use in combination with cold headers in a number of prominent bolt and cap screw plants . . . two plants are completely equipped and have achieved marked economies in manufacture and also in improved product and increased die life.

✦ ✦ ✦

THE wire drawing machine is operated by power supplied from the header.

✦ ✦ ✦

THIS machine cold draws and coats hot-rolled, pickled and limed rod as it feeds into the machine.

✦ ✦ ✦

THE wire drawer is set directly in front of the header and the die is moved back and forth along the wire rod instead of having a stationary die and pulling the rod through the die to draw it down to size.

✦ ✦ ✦

Operation Extremely Simple

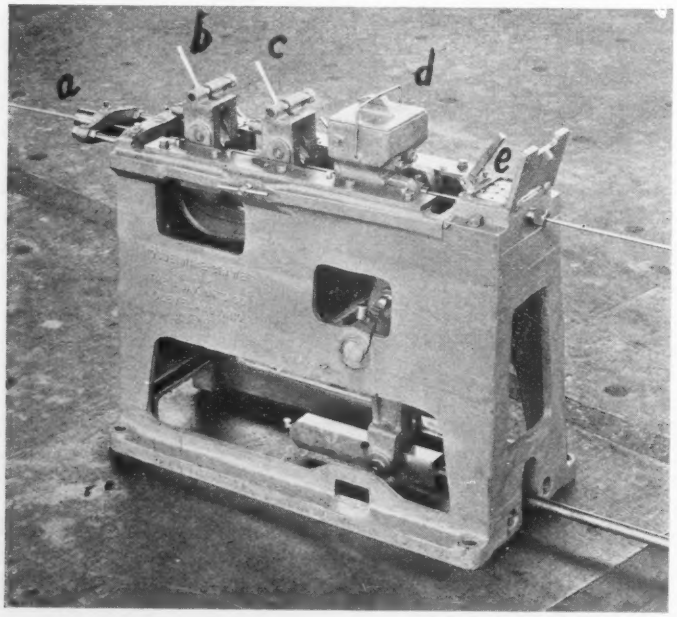
THE wire drawing equipment is extremely simple in operation. The stock is fed into the heading machine by the regular feed rolls in the usual manner. During the periods between feeds the wire is held securely by grips and the drawing die is pushed back along the rod a distance equal to the amount fed. When the feed occurs the grips release and the drawing die and the slide which carries it move forward with the rod, being pushed back again during the next stationary period.

✦ ✦ ✦

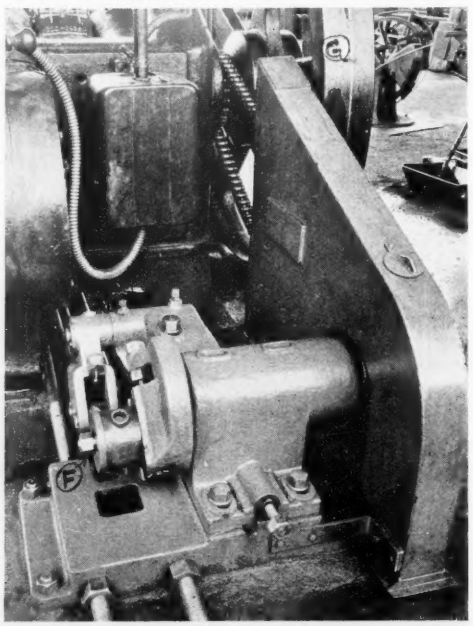
THE slide which carries the drawing die is of box shape at the top and is filled with drawing and coating powder lubricant which simultaneously coats the stock for cold heading and extruding operations.

✦ ✦ ✦

MOTION is imparted to the drawing die slide by a vertical lever fulcrumed in the drawer frame beneath the slide, which in turn derives its motion through a long horizontal connecting rod located under the header from an adjustable crankpin at the back of



Operating parts: Straightener bushing (a), inching grip (c), drawing die slide (d), and automatic grips (e). ✦ ✦ ✦ ✦ ✦ ✦ ✦



Adjustable crank pin (f) driven by roller chain from crankshaft of header (g). ✦ ✦ ✦

the heading machine. This pin is on the end of a crankshaft mounted in an independent housing rigidly connected to the front drawer frame by spacer bolts and is driven by chain and sprocket from the crankshaft of the header.

✦ ✦ ✦

THE stroke of the mechanism that actuates the die slide is adjustable so that in each cycle the length of the wire that is drawn is the length of the bolt that is being headed, plus enough material to make the head.

✦ ✦ ✦

No Appreciable Increase In Power

THE drawing operation does not overlap the peak power demand of the header which, combined with the easier heading of the drawn stock, results in no appreciable increase in power required because of the addition of the wire drawing equipment. The standard headers with which the Ajar attachment is equipped are driven by the same motors that were used before the wire drawing devices were attached to the header.

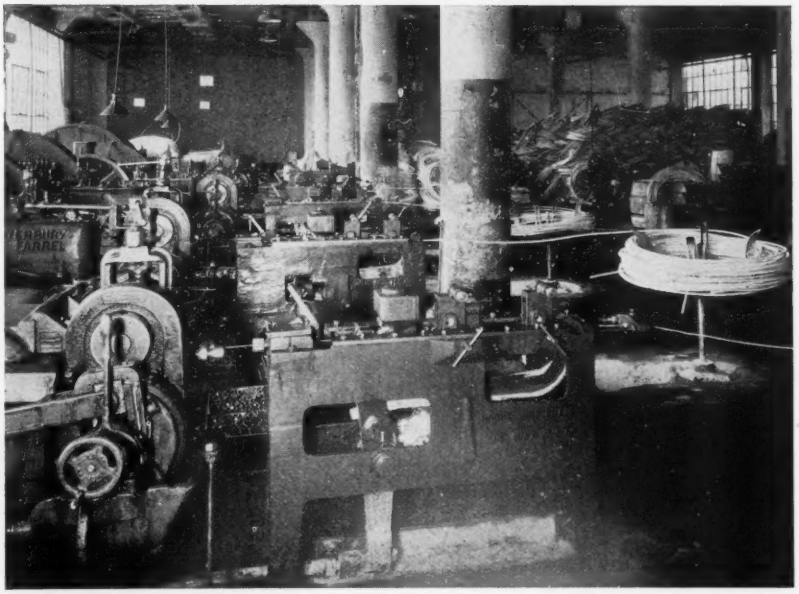
✦ ✦ ✦

Pointing or Swaging Lessened

FOR starting the end of new coils of rod an "inching" feed is provided. This starting mechanism consists of an auxiliary grip and a feed slide with short stroke hooked up to and operating from the vertical lever. This feed slide pushes the rod forward one to three inches at a time and the auxiliary grips hold it during drawing until the main drawer grips it and the feed rolls of the header are reached, when the operation is resumed. The use of the "inching" feed makes the pointing or swaging of the rod unnecessary, except for ¼-in. and smaller sizes, before it goes into the heading dies.

✦ ✦ ✦

THE coil of wire rod is set on the reel in front of the wire drawer and, as the material is straightened in going through the block, wire enters the header perfectly straight. In addition, the heat generated in drawing is claimed to be sufficient to cause the metal to flow more easily in the header dies and to prolong the life of these dies. Another factor that tends to extend the life of the header dies is that the freshly drawn wire is clean, while wire that has been kept in storage bins becomes dirty and often collects sand, grit, and other abrasives which is hard on the dies.



Complete installation of Ajax-Hogue Wire Drawers in prominent bolt and cap screw plant. ✦

✦ ✦ ✦

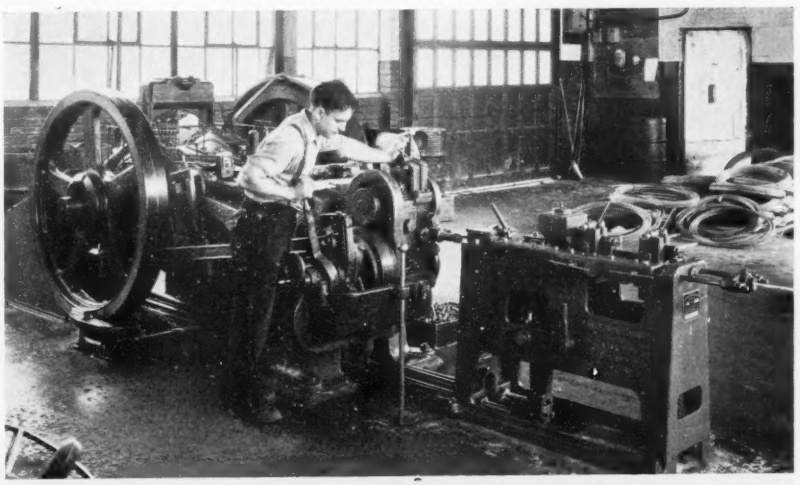
A SET of tungsten carbide dies used in bolt headers when the first attachment was placed in operation over a year ago, is still in good condition.

✦ ✦ ✦

Economies and Advantages

CONSIDERABLE saving in production costs, particularly in raw material, has been effected by users who are drawing wire and heading bolts with the combined equipment. The saving in cost of wire rods as compared with wire is about $15 per ton for plain steel and much higher for alloy steels. The amount of inventory has been reduced one-third, the number of sizes carried in stock has been cut down and the floor

(*Please turn to page 123*)



View showing set up of Ajax-Hogue Wire Drawer in combination with cold header. ✦ ✦

FIRTHELD SUPE

FIRTHALOY SINTERED CARBIDE

for

WIRE DRAWING DIES

TUBE DRAWING DIES

EXTRUDING DIES

EYELET AND FERRULE DIES

SIZING DIES

BURNISHING DIES

COATING DIES

SWEDGING DIES

STRANDING DIES

MANDRELS

GUIDES, ETC.

SHAPED DIES
(Hex. Oct. Rect. Sq.)

SPECIAL SHAPED DIES
(On application)

SPRING WIRE APPLICATIONS

WIRE CURLING DIES
(Coiling Points or Bumpers)

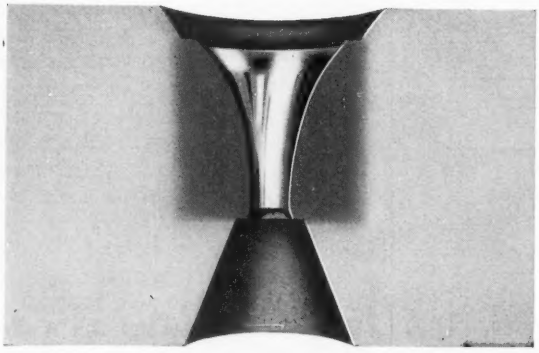
WIRE GUIDES

ARBORS OR MANDRELS, ETC.

FIRTHELD

The name for the SUPER DIE CASING developed by the Firthaloy Engineering Department

PER DIE CASING



A half-section of a Firthaloy Die shows how the Firthaloy Nib is held in the new Firtheld Casing.

DIE BREAKAGES ARE COSTLY---AVOID THEM WITH FIRTHALOY

The need for a casing that would combine toughness, hardness, low expansion and high tensile strength has been evident ever since the advent of Sintered Carbide Dies. The Firthaloy Engineering Department has developed a Super Die Casing that includes all these qualities. Recent refinements have almost doubled the tensile strength of the Casing Material used.

The Firthaloy Die Nibs are held in the Firtheld Casing by a fused bond forming a perfect weld between the nib and the casing. This holds and supports the nib against all stresses set up in the Drawing Operations. The high heat generated by modern high speed drawing has little effect on Firthaloy Die Nibs held in Firtheld Casings. In the Firtheld Casing there is no brazing to melt or soften, and there is no destructive movement set up by differences in expansion and contraction at drawing temperatures.

This type of casing practically eliminates the breakage due to shock and to quick starting die blocks.

Our customers' reports covering thousands of Firthaloy Dies, Firtheld Cased, show that in very many cases the Dies have been recut far beyond the maximum guaranteed recut value.

For longer Die life, less Breakage, and more Recuts, we recommend Firthaloy Dies Firtheld Cased. They cost no more.

FIRTH-STERLING STEEL COMPANY

GENERAL OFFICE AND WORKS
McKEESPORT, PA.
BRANCH OFFICES AND WAREHOUSES
NEW YORK CHICAGO
HARTFORD CLEVELAND
DETROIT PHILADELPHIA
LOS ANGELES

Exports and Imports of Wire

Exports of Iron and Steel Wire Products in Dec. 1934 and Dec. 1933
(In gross tons)

	Dec. 1934	Nov. 1934	Dec. 1933
Wire rods	460	3,710	3,210
Hoops, bands and strip steel	3,528	2,027	1,871
Plain black or galvanized iron or steel wire	2,821	2,034	3,346
Barbed wire and woven wire fencing	2,763	2,570	3,545
Woven wire screen cloth	66	64	98
Wire rope	149	212	232
Insulated iron or steel wire and cable—see analysis below			
Other wire and manufactures	338	337	316
Wire nails	1,017	1,044	1,115
Tacks	29	46	43
Other nails, including staples	259	215	272
Bolts, machine screws, nuts, rivets and washers	533	434	436
Total, these 11 classifications	11,963	12,693	14,484

Imports of Iron and Steel wire Products Into The United States
(In gross tons)

Concrete reinforcement bars	37	101	116
Hollow bars and drill steel	59	43	102
Merchant steel bars	1,443	1,696	2,082
Wire rods	962	880	1,143
Barbed wire	332	294	1,385
Round iron and steel wire	211	209	192
Telephone and telegraph wire	3	1	1
Flat wire and strip steel	180	216	134
Wire rope and strand	80	60	201
Other wire	52	64	111
Hoops and bands	1,033	1,840	1,267
Nails, tacks and staples	435	486	324
Bolts, nuts and rivets	8	29	27
Total, these 13 classifications	4,735	5,921	7,085

EXPORTS of iron and steel from the United States during December totaled 282,655 gross tons —16,608 tons or 5.5 percent less than in November. Even so there were 37 classes of products which showed increased shipments against 23 in which the trade declined with one item—welded casing and oil line pipe—having the same trade each month. The month's greatest increase was that in tin plate—5,768 tons—which was followed by gains of 4,135 tons in heavy rail exports, of 2,155 tons in the shipments of seamless casing and oil line pipe, of 2,036 tons in the trade in steel bars, and 1,020 tons in the trade in light rails. On the other side of the ledger were such decreases as that in scrap, 20,205 tons, in skelp, 10,630 tons, in wire rods, 3,250 tons, in ingots, 1,948 tons, and in galvanized steel sheets, 1,119 tons.

✦ ✦ ✦

JAPAN was, as usual, the principal buyer taking 140,750 tons in all of which 130,356 tons was scrap, 5,090 tons was tin plate, and 1,464 tons was steel bars. Scrap was the leading item in the trade with the other four principal markets of the month constituting 26,925 tons out of Italy's 27,021-ton total, 17,356 tons out of the 17,928 tons sent the United Kingdom, 7,134 tons out of the 18,086 tons shipped to Canada, and 2,687 tons of China's 10,039-ton total. Other products of importance in the trade with Canada were black steel sheets—1,942 tons, hoops and bands—1,281 tons, and cold rolled strip steel—928 tons, while the trade with China included, in addition to the scrap mentioned above, 3,366 tons of heavy rails, 1,649 tons of steel bars, and 1,469 tons of tin plate.

✦ ✦ ✦

Imports

AT 19,708 tons imports of iron and steel products were lower than in any month since July. Compared with November when the trade totaled 35,272 tons, the December receipts were smaller by 44 per cent or 15,564 tons. There were 17 classes of products in which gains were registered, and three classes in which there was no trade in either month. The outstanding decrease was that in ferro-manganese and spiegeleisen —a matter of 7,292 tons—while other decreases of moment were those recorded in scrap (3,117 tons), pig iron (2,413 tons), structural shapes (1,666 tons), and hoops and bands (807 tons). None of the increases were in large amount—the chief being those in ferro-silicon (229 tons), and in sponge iron (102 tons).

✦ ✦ ✦

ON a tonnage basis scrap iron and steel was the principal product in the December import trade—its total of 4,489 tons including 4,469 tons which came from Canada and 20 tons marked as from Sweden. Next was pig iron of which only 3,642 tons were received in December, this total being made up of 3,308 tons from British India, 284 tons from Canada, and the remaining 50 tons from Belgium. In this connection it is of interest to note that for the first time in months the Netherlands was not a factor in the pig iron import trade of the United States. Despite the sharp reduction noted in the preceding paragraph ferro-manganese and spiegeleisen—3,534 tons—was the third largest item in this trade—principal suppliers being Canada (2,075 tons), Norway (967 tons), and the Netherlands (258 tons). Structural shapes was the fourth item in the December receipts, its total of 1,662 tons including 1,438 tons from Belgium and 207 tons from Germany, while merchant and other steel bars followed with Belgium supplying 969 tons and Sweden 280 tons of the 1,443-ton total. Hoops and bands constituted the only other item the receipts of which exceeded 1,000 tons in December—its total of 1,033 tons including 901 tons from Belgium.

✦ ✦ ✦

CARD clothing imports—8,211 square feet valued at $12,760 —were increased over November, and included 7,425 square feet ($10,903) came from Germany, Belgium and Switzerland.

✦ ✦ ✦

WIRE cloth and screening receipts declined in December to only 45,520 square feet. Of this quantity 33,782 square feet came

(Please turn to page 119)

A Review of Recent Wire Patents

No. 1,986,021, HOLDER FOR WIRE DRAWING DIES, Patented January 1, 1935, by Oscar Sjogren, Auburn, Mass.

The inventor provides for cooling of the die by circulation of water through the die blank holder.

✦ ✦ ✦

No. 1,986,255, MATTRESS AND SIMILAR STRUCTURE, Patented January 1, 1935, by Claude Harold Durfey, Mount Vernon, Archibald W. Naylor, Brooklyn, Joseph N. Bauer, Astoria, Long Island, and Roger B. Stevens, New York, N. Y., assignors to Mabrand Products, Inc., Long Island City, N. Y., a corporation of New York.

In this mattress construction, the boxing is kept taut by springs along the outer edges but without tying the springs to the boxing.

✦ ✦ ✦

No. 1,986,256, ENCLOSURE FOR BOTTLES AND OTHER CONTAINERS, Patented January 1, 1935, by Norman Stanley Ellis, Hamilton, Ontario, Canada, assignor to Metal Textile Corporation, West Orange, N. J., a corporation of Delaware.

This is a shape conforming protective jacket for bottles and comprises an elastic sleeve of metallic fiber knitted from a single run of flexible wire.

✦ ✦ ✦

No. 1,986,733, WIRE COATING APPARATUS, Patented January 1, 1935, by William E. Leonard, Worcester, Mass., assignor to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

The inventor aims to provide coated wire free of grease and with a clean shiny finish. As the wire leaves the coating fluid containing tank, it is wiped by a rubber wipe and then contacted by a number of fine wires fixed next to the rubber wipe and wrapped about the wire.

✦ ✦ ✦

No. 1,986,777, DEVICE FOR DRAWING WIRE, Patented January 1, 1935, by Henry R. Patterson, Pittsburgh, Pa., assignor to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

More particularly, the invention relates to a means for holding a die, such as composed of tungsten carbide, in such a manner as to permit of its slow cooling without actually being in contact with the coolant.

✦ ✦ ✦

No. 1,986,839, BED BOTTOM, Patented January 8, 1935, by Reinhold W. Marquardt, Milwaukee, Wisconsin, assignor to Marquardt Company, Milwaukee, Wis., a corporation of Wisconsin.

Means is provided for connecting the support coil springs at the ends of a series and the intermediate coil springs of such a series to a woven wire webbing so as to support the latter.

✦ ✦ ✦

No. 1,987,079, WIRE SPOOLING MACHINE, Patented January 8, 1935, by Alfred L. Rosenmund, Rockaway Borough, N. J., assignor to Stapling Machines Co., a corporation of Delaware.

This machine is adapted to automatically uncoil a rough coil of wire, straighten or smooth the wire, and then recoil it evenly on a reel or spool.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 17 East 42nd St., New York.

No. 1,987,088, HIGH FREQUENCY CABLE, Patented January 8, 1935, by Ludwig Walter, Berlin, Germany, assignor to Telefunken Gesellschaft fur Drahtlose Telegraphie m. b. H., Berlin, Germany, a corporation of Germany.

The invention lies in the provision of an insulating material comprising quartz wool.

✦ ✦ ✦

No. 1,987,333, MACHINE FOR BENDING WIRE AND THE LIKE, Patented January 8, 1935, by Harry R. Geer, Westmont, Pa., assignor to Bethlehem Steel Company, a corporation of Pennsylvania.

More specifically, the machine is particularly adapted for forming heavy wire with hook ends so as to provide core members for reels or spools, the reels or spools being adapted to carry barbed wire and the like.

✦ ✦ ✦

No. 1,987,334, MACHINE FOR BENDING WIRE AND THE LIKE, Patented January 8, 1935, by Harry R. Geer, Westmont, Pa., assignor to Bethlehem Steel Company, a corporation of Pennsylvania.

This machine is adapted for forming the reel wire spool end associated with the devices provided by the next above described apparatus.

✦ ✦ ✦

No. 1,987,416, SUBMARINE TELEGRAPH CABLE, Patented January 8, 1935, by Robert L. Peek, Jr., Union, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York.

This cable is adapted for small traffic demands and is without an outer armoring. The core comprises a strand of aluminum alloy containing manganese and silicon in an amount not to exceed 2%.

✦ ✦ ✦

No. 1.987,442, SIGNALING CABLE, Patented January 8, 1935, by Henry J. Harris, Westfield, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York.

For a high frequency signaling cable, the inventor provides a number of groups of at least three bare conductors each, the dielectric between all of the conductors being largely gaseous. A strand of insulating material is wound helically about each of the groups, and a second, central strand of insulating material emerging on successively different sides of each of a group to loop over successive convolutions of the helical strand.

✦ ✦ ✦

No. 1.987,508, INSULATED CABLE, Patented January 8, 1935, by Hays Johns and Verne F. Dobbins, Cleveland, Ohio, assignors by mesne assignments, to Sterling Cable Corporation, a corporation of Michigan.

This cable comprises an exterior coating of cellulose lacquer having uniformly interspersed therein a finely divided electrically conductive material, the individual particles of which are separated by thin layers of lacquer and the conductive material being in such proportions as to provide a conductive static and magnetic shield about the cable. Preferably, the electrically conductive material is powdered aluminum.

✦ ✦ ✦

No. 1,987,741, WIRE STRAIGHTENER, Patented January 15, 1935, by Charles D. Johnson, Worcester, Mass., assignor to Johnson Steel & Wire Company, Inc., Worcester, Mass., a corporation of Massachusetts.

This wire straightener is of the two-way type and provision is made for delivering the wire to each straightener substantially free of tension.

✦ ✦ ✦

No. 1,988,437, STRAND REELING MACHINE, Patented January 22, 1935, by Samuel E. Brillhart and Austin Le Boutillier, Baltimore, Md., assignors to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

In this strand reeling machine, a device is provided engageable with the reel to drive the same and co-acting therewith to catch, sever and grop the wire strand to be reeled on the reel.

✦ ✦ ✦

No. 1,988,950, MACHINE FOR MANUFACTURING CABLE, Patented January 22, 1935, by Homer G. Knoderer, Fairfield, and George Carlson, Bridgeport, Conn., assignors to General Electric Company, a corporation of New York.

More specifically, the machine is provided for simultaneously applying a number of strands and a metal armor about an insulated wire conductor.

✦ ✦ ✦

Reissue No. 19,444, METHOD OF AND APPARATUS FOR VULCANIZING MATERIAL ON ARTICLES, Patented January 29, 1935, by Leslie Fawcett Lamplough, Baltimore, Md., assignor to Western Electric Company, Inc., New York, a corporation of New York.

The invention relates to an apparatus for continuously applying and forming a covering of vulcanized materials on conductors.

✦ ✦ ✦

No. 1,989,236, COMPOSITE WIRE, Patented January 29, 1935, by Clemns A. Laise, Haworth, N. J., assignor to Eisler Electric Corporation, a corporation of Delaware.

The invention relates to a composite wire for lead in wires for incandescent electric lamps and the like. The core of the wire is of nickle alloy having a metallic sheath of nickle-containing metal, the sheath being saturated with hydrogen.

✦ ✦ ✦

No. 1.989,302, SPRING STRUCTURE, Patented January 29, 1935, by William H. Wilmot, Asheville, N. C.

In this spring structure, the springs are interconnected mid-way their length only, the end portions of the springs being free and unconnected.

Ferrous Sulphate and the Lime Tub

By MERRILL E. LEITCH, Holyoke, Mass.

THERE is an understandable tendency on the part of the cleaning department to postpone the emptying and cleaning of the vitriol tanks as long as possible in the interests of economy. But with this increased tonnage of cleaned wire per tank there is also the attending difficulty of increased ferrous sulphate content.

✦ ✦ ✦

UNDOUBTEDLY, there are those who believe that a high-pressure washing hose is a sufficient answer to this problem while others may assume that the lime tub will neutralize all residual acid products. As one of the functions of the lime tub is to inhibit rusting, the appearance of rusty wire from the bake-house might lead one to conclude that the lime tub was at fault. In either case when the rods go wrong it is probably the lime tub or the bake house that is blamed.

✦ ✦ ✦

WHEN the vitriol tanks contain an appreciable amount of sulphate content the rods coming from this solution, if allowed to dry at this point, would be seen to be covered with this crystalline deposit.

✦ ✦ ✦

THE hose serves only to wash that part of the coil with which it comes in contact. If it were possible to thoroughly wash each blade of rods, this contamination would not be so important but complete wash, i. e. to the point of chemical cleanliness, can hardly be expected if the rods are to any degree compact. This inadequacy in washing will be noticed more especially at the bottom of the coil in the inner portion of the bundle.

✦ ✦ ✦

WHEN ferrous sulphate is carried over on the wire into the lime tub a chemical reaction takes place resulting in the formation of Ferrous Hydroxide.

$$FeSO_4 + Ca(OH)_2 = Fe(OH)_2 + CaSO_4$$

The Ferrous Hydroxide is readily oxidized in the bake house to the reddish-brown Ferric Hydroxide, also know as Hydrated Ferric Oxide, Fe_2O_3, x H_2O.

✦ ✦ ✦

THE complaint of the wire-drawer that the wire is wet seems

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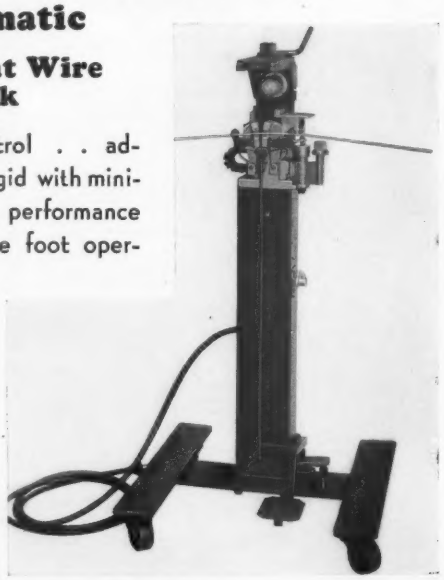
A practical unit for either intermittent welding with fabricating machinery, or for continuous production welding. Leaves operator's hands free at all times to handle material being welded.



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more reasonable when we consider that this Oxide may carry one, two or three molecules of water of crystallization.

✦ ✦ ✦

THIS sulphate trouble is characterized by an excessive and loosely held brown incrustation appearing as rusty sections after the rods leave the bake house. These sections become more apparent as the bundle is spread out and they indicate that portion of the bundle which was not hit by the hose. These rusty sections are not "drawn in" having no tenacity to the wire. They act only to contaminate the lime coating, ruin the soap-box and subsequently, the dies.

✦ ✦ ✦

IF this condition is encountered the proper diagnosis is the important thing and then the necessary steps may be taken to rectify the trouble. They may consist of allowing more spread on the blade, the installation of a rinsing tank, allowing less tonnage per vitriol tank or perhaps all three together.

✦ ✦ ✦

In connection with the information contained in the above article, attention is called by Mr. Kenneth B. Lewis, wire mill consulting engineer, to the fact that ferrous sulphate is over three times more soluble in hot water than in cold water, the temperature of greatest solubility being about 170° Fahrenheit.

✦ ✦ ✦

J. H. Vohr
Superintendent New Hot Strip Mill, Youngstown Sheet & Tube Company

J. H. VOHR who came to the Youngstown Sheet & Tube Company several months ago to supervise the construction of the new hot strip mill, has been made superintendent.

✦ ✦ ✦

MR. Vohr is a graduate of Cornell University and served in the Army as a commissioned pilot in the aviation section. He started in the steel industry as an engineer in charge of construction at the American Sheet & Tin Plate Company mill at Farrell. After 12 years he became assistant superintendent of the strip mill at the company's Gary plant and some years later he became assistant superintendent of the wide strip mill of the Inland Steel Company.

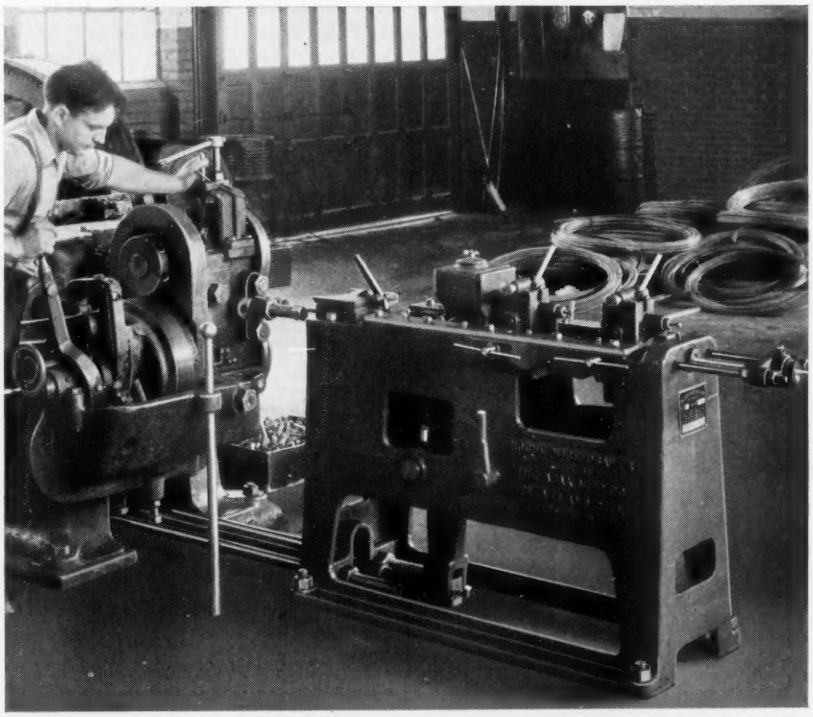
✦ ✦ ✦

Walter E. Hadley
General Superintendent of Gary Plant of Illinois Steel Co.

EFFECTIVE February 12th, the appointment of **Walter E. Hadley** as general superintendent of mill operations at the Gary plant of the Illinois Steel Company has been announced. Mr. Hadley has been assistant superintendent at the plant for the past seventeen years and succeeds William P. Gleason who is retiring on his 70th birthday under the pension and retirement plan of the United States Steel Corp.

IF YOU OPERATE COLD HEADERS!

● Marked economies in material costs, in operating costs, in die life, and product improvement, are being effected with the Ajax Hogue Wire Drawer on cold headers . . investigate it immediately . . write for Bulletin No. 110 . . it's yours for the asking!



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Hydrogen Embrittlement Occuring in the Pickling Solution for Rods

By William M. Lease, Jr.
Head Pickler, Wire Mill, Bethlehem Steel Co.,
Sparrows Point, Md.

Some observations on the causes of hydrogen embrittlement and methods for relief of brittleness resulting therefrom. ✦ ✦ ✦ ✦ ✦

LATELY there has been much comment and research going on due to the fact that carbon steel becomes weakened in the process of pickling.

✦ ✦ ✦

THIS is very true as we have the results of many tests and laboratories to prove this fact and because of these results the manufacturer is becoming alarmed. But this embrittlement due to occluded hydrogen is not a cause of any great danger in steel. The cause of this brittleness referred to is not a phenomenon that enters into the manufacture of wire to any great extent, it is merely temporary and will soon pass away leaving the rod or wire with the same qualities it had before the hydrogen embrittlement took place.

✦ ✦ ✦

OF course the degree of embrittlement depends upon the quality of the steel as well as upon the conditions of pickling. As far as is generally known there is yet no conclusive test regarding how the hydrogen is absorbed and how the same atoms of sorbed hydrogen are diffused through the mass of solid steel. But two prominent chemists* have proved that "At ordinary temperatures hydrogen gas does not penetrate iron or steel. At a red heat, however, hydrogen diffuses through iron readily, presumably because of the opening of the space lattice and the decreased rigidity of the crystalline structure. At both low and high temperatures it is the hydrogen molecule which must penetrate the iron. If hydrogen is produced in contact with iron in a nascent or atomic condition, it readily penetrates the iron even at room temperature. The small size of the hydrogen atom as compared with the hydrogen molecule accounts for the fact that nascent hydrogen can penetrate iron at temperatures at which molecular hydrogen cannot." A prominent Russian chemist† has shown that "sorptive forces can cause spontaneous pulverization, so that with some mechanical assistance some of the softer metals may be reduced to powder. It is apparent that the sorbed hydrogen can eventually collect in the form of local concentration, areas of which may distort the space lattices."

✦ ✦ ✦

FROM the foregoing paragraph it is seen the absorption is a very complex action and there is more yet to be learned upon the subject. But there are certain experimental facts that are known. The brittleness produced by pickling a particular steel in general is greatest when the steel is in its hardest condition and least when the steel is in its softest condition.

✦ ✦ ✦

IMMERSION in boiling water for about 10 or 15 minutes removes the brittleness giving practically the maximum recovery. Baking the wire or rod in ovens is the way brittleness is relieved in the mill today, although the primary reason for baking is to dry the lime to keep additional oxide from forming before the rod is drawn. One or two hours is usually sufficient to relieve this embrittlement in most carbon steels if the heat is sufficient. The time of recovery is directly proportional to the heat of the ovens.

✦ ✦ ✦

THE embrittling of steel by pickling may be accompanied by a reduction in tensile strength. Such a reduction has only been observed in steels which are capable of being rendered relatively hard by heat treatment and in these steels only after hardening and tempering at lower moderate temperatures.

✦ ✦ ✦

THIS condition may be lessened by adding inhibitors to the pickling solution but inhibitors never entirely stop the hydrogen embrittlement. An interesting fact is that during the pickling of high carbon steel the addition of inhibitors does not decrease the embrittlement while the decrease on lower carbon steel is appreciable enough to warrant the purchase of inhibitors. The effectiveness of inhibitors decreases with the increase in temperature of the bath.

✦ ✦ ✦

RECENTLY this writer made tests of No. 5 rod .60 carbon steel about 6" long using a well known inhibitor. The rod in question was put in a solution of 6% H_2SO_4 by volume and a temperature of 120° F. It was descaled in 30 minutes but was left immersed for 36 hours. During this time considerable action was noticed in the solution but the surface of the rod remained unpitted and perfectly smooth. After the 36 hours the rod was taken out and dried. The most interesting phenomenon was that the outside pulled free from the inside and left a perfect pipe showing that the layer of steel un-

(*Please turn to page 122*)

* Jeffries & Archer.
† L. G. Gurwitsch—Journal of Russian Physical Chemical Soc. 1916 Vol. 48.

'Round the World With the Wire Industry

Rolled Wire in Germany

ROLLED wire production in Germany has progressively advanced during the past several years. The seasonal declines in the output evident prior to 1934 have not been nearly so pronounced during that year, and the output during the January-October 1934 period reached 460,493 metric tons, a gain of 15.3 percent and of 37.6 percent over that produced during the corresponding periods of 1933 and 1932, respectively. Consumption of rolled wire in the German market during the initial 10-month period of 1934 totaled 66,379 tons, representing a gain of 1.2 percent and of 3.5 percent over consumption during the corresponding periods of 1933 and 1932, respectively. Increased activities in the machinery and electro-technical industry have reacted strongly on the consumption, with demand brisk from other consumers.

✦ ✦ ✦

Market for Lead Headed Nails in India

LEAD-HEADED nails are not sold in the Indian market at the present time, but there is a possibility that a market could be developed. A very large quantity of corrugated iron and asbestos sheeting is used for roofing, and it is possible that such nails might be adapted for use in the construction of roofs made of those materials. At the present time, corrugated sheets are fastened by ordinary steel bolts rather than with clamps, and not much wood is used in construction in India, steel being used in practically all cases which would seem to indicate that the demand for fasteners would be better than that for nails.

✦ ✦ ✦

Steel Rolling Mill in South India

A STEEL rolling mill at Negapatam in South India for the manufacture of mild steel bars, rounds, flats and squares for catering to the needs in Tanjore and other adjoining districts is in the course of erection. Machinery for the plant was imported from Manchester, bought secondhanded from a dismantled mill. It is reported it is negotiating locally for scrap material, and that if supplies are not readily available raw material will be purchased from Belgium. The plant is not expected to start production until the Pykara electric current becomes available in that territory.

✦ ✦ ✦

International Wire Cartel Prices

THE International Machine Wire Cartel met at Brussels, Belgium, on December 12 last and decided to augment the tonnage for the first quarter of 1935 from 320,000 tons to 350,000 tons, in view of a market improvement. The sales prices were raised from 1 to 2 shillings per ton due to minimized competition in certain foreign markets. It was brought out, however, that foreign competition is on the increase, and that the Japanese must be reckoned with in the Far East.

✦ ✦ ✦

Indian Tube Co., Ltd., Starts Operations

THE Indian Tube Co. Ltd., Calcutta, India, using modern British equipment, and equipped to turn out butt welded steel tubes up to 2 inches in diameter at a rate of about three tons of strip per hour has just commenced operation. The plant is practically automatic throughout, and can also turn out special lines of tubing such as tubular point rod, vacuum brake pipe, coils, etc., all to British Standard I. B. and L. S. D. specifications.

✦ ✦ ✦

IWECO Export Price Difficulties

THE official wire export prices of the IWECO cannot be realized for all markets. The very keen competition is an obstacle. Present quotations are therefore lower than the official prices and the following quotations are ruling: Plain wire £ 5.5.0 base price Wire nails £ 5.10, Barbed wire 8.10, Galvanized wire 6.7.6, all in Gold Pounds fob. In some cases however quotations are s 3/ per ton below these prices.

✦ ✦ ✦

American Cotton Exchanged for German Wire Products

A FIRST barter contract with Cotton shippers from New Orleans includes among other things 2 to 3000 tons cotton baling ties and 400 tons of barbed wire and galvanized fencing wire, as well as various types of machinery.

✦ ✦ ✦

Japanese Wire Industry Improves

THE Japanese wire industry has apparently regained full strength. In January the Japanese competition was not lowered in strength by the Taifun disaster. However the Japanese prices are not lower than before August but in almost all markets by s 2/6—4 per ton higher.

✦ ✦ ✦

German Wire Gauze

THE German wire gauze export business is being reorganized in such a way, that export counsels are appointed in more than 14 different markets and 6-7 to follow. These export counsels give advice to the wire gauze and also the wire rope industry. The markets are working uniformly by a common plan and orders are distributed.

✦ ✦ ✦

German Steel Industry Prosperous in 1934

THE German steel industry had a very prosperous year in 1934. Export business gained extraordinarily in size, due to barter trading. The total figure was up by 1,670,000 tons compared with 1933. The wire industry is also participating in this improvement, particularly at the end of 1933, as may

be seen from the following figures: Export average per month of all wire products together first half 1934—13,000 tons per month, July 13,800 tons, August 15,300 tons, September 15,900 tons, October 17,300 tons, November 17,800 tons and December 18,700 tons. A further rise is possible. Nearly 30% of the total wire export trade is by barter and this percentage is likely to be increased in 1935. But prices are unsatisfactory.

✦ ✦ ✦

German Wire Prices Recently Reduced

THE German cartel due to the market expansion in 1934 (at the end of the year the steel industry was working at 70% of capacity, and the wire industry at 60%), was able to announce reduction of prices. On January 1st-10th the extras for wire products were reduced by 12-15% and the base prices by 6-10 Marks per ton according to the quantity, wire ropes by 12 Marks per ton.

✦ ✦ ✦

Venezuela Buys American Washers

VENEZUELAN import statistics show that the greater part of imports of washers into Venezuela come from the United States. The imports of washers into Caracas are relatively small, the bulk of such being made through the ports of Las Piedras, Maracaibo and La Vela and are intended for the petroleum companies operating near those parts. Iron and steel washers are classified separately only for the first six months of 1933, during which time there was received 27,690 kilograms, valued at 21,471 bolivares. Following the United States, Germany and England are the chief participators in this trade.

✦ ✦ ✦

Saar Return Relieves German Situation

THE return of the Saar to Germany will relieve the external trade situation. Germany has imported so far more than 105 Million Marks steel products from the Saar, for which payment had to be made in French francs. Approximately 50,000 tons of wire rods and wire products were imported from the Saar last year and this will naturally influence the foreign trade figures rather impressively.

✦ ✦ ✦

PRICES for wire ropes on the export market have advanced by 4-6% since November.

✦ ✦ ✦

Some Foreign Trade Opportunities

AN importer in Belgium has informed the Consul at Liege that he is interested in purchasing American steel wire strand. Interested subscribers may obtain further particulars regarding this matter by addressing the Bureau direct or communicating with its district or co-operative offices and referring to Trade Opportunity No. 8302.

✦ ✦ ✦

THE Consul at Sao Paulo advises regarding the interest of a Brazilian representative in securing an American account for shoe nails. Further particulars may be obtained by addressing the Bureau direct or through its district or co-operative offices and referring to Trade Opportunity No. 8179.

✦ ✦ ✦

THE American Consul at Kingston, Jamaica, has been approached by a local representative desirous of handling an American line of barbed wire and nails. By addressing the Bureau direct or communicating with its District or Co-operative Offices interested firms may obtain further particulars regarding this trade opportunity which is numbered 8176.

✦ ✦ ✦

A FIRM of representatives at Capetown, Union of South Africa, has expressed interest in representing a line of wire or strips for use on orange cases, according to information from the Consul at that place. By addressing the Bureau direct or communicating with its district or co-operative offices, and referring to trade opportunity No. 8177, interested subscribers may obtain further particulars.

✦ ✦ ✦

Wire Cloth Builds Business

ANY person now buying one carload of wire cloth, stimulates business to the extent that the following are required for the manufacture of this carload: Wire, 31,000 pounds; wire rods, 33,000 pounds; billets, 36,000 pounds; ingots, 38,000 pounds; pig iron or scrap, 40,000 pounds; iron ore, 80,000 pounds; coke, 40,000 pounds; coal, 60,000 pounds; limestone, 20,000 pounds. So states Frank W. Jones, vice president and general manager, Hanover Wire Cloth Co., Hanover, Pa.

Kelly Wire Die Corporation

✦

TANTALUM

TUNGSTEN

&

DIAMOND

DIES

✦

Kelly Wire Die Corporation

256 W. 31st St., NEW YORK

Patenting Temperatures

(*Continued from page 105*)

are of the same general S shape with a wide bulge parallel to the time axis.

✦ ✦ ✦

IT is noted at once that there are two temperature zones in which the transformation is comparatively fast, 930/1110° (500/600° C.) and below 300° (150° C.). In the upper zone the product is fine pearlite, and in the lower it is martensite. In the zone between 300° and 390° (150° and 200° C.) the time required for the transformation is so long that it could almost be said that austenite is stable at that temperature.

✦ ✦ ✦

THIS data furnishes an explanation of earlier experiments, particularly of those of DARTREY LEWIS on the stability of austenite in a eutectoid steel quenched at 542° (232° C.) (Iron and Steel Institute May 1929). It also explains the well known phenomenon of the splitting of the transformation point at a certain rate of cooling. With a moderate rate of cooling the metal stays in the upper zone of rapid transformation long enough to be completely transformed. With a higher rate of cooling the austenite persists through the upper zone; then the reaction goes on so slowly that the austenite carries through to the lower zone of rapid transformation and the change is to martensite.

✦ ✦ ✦

IF we examine the curves of figure 207 we see that the complete transformation of an .80 carbon steel takes place in about 10 seconds at the temperature of 930° (500° C.) which is the temperature of the lead bath in patenting. The transformation is therefore complete before the wire leaves the lead, at the speed of travel and length of lead pot which we have established as correct.

✦ ✦ ✦

THESE curves show the effect of a lead bath either hotter or colder than standard practise. If the bath temperature goes down to 750° (400° C.) there would remain in the steel a considerable amount of austenite which would transform at about 390° (200° C.) to troosto-martensite, the structure which we find in a poorly treated wire. If the lead bath is too hot it is seen that there will be a slower transformation with deposition of ferrite and a more or less fine pearlite.

✦ ✦ ✦

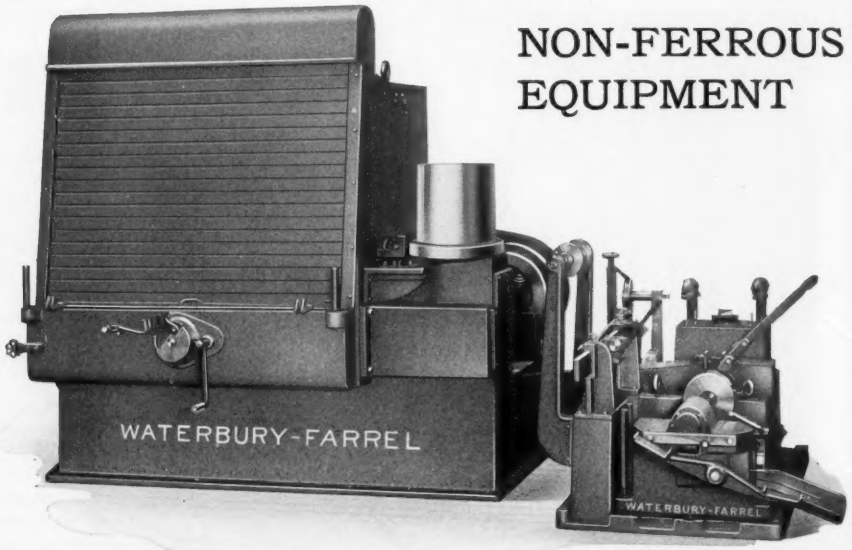
THIS theoretical discussion, though it has been brief and reduced to its simplest outline, shows how the figure of 930° (500° C.) for the lead bath is justifiable on a theoretical basis. This is another instance where shop practise had beaten a trail before scientific study came along. Shop practise seems to be absolutely correct, but although science is apparently unable to do anything to improve the patenting of carbon steel wire, research based upon theoretical grounds may very probably lead to the extension of this practise into the alloy steels, with very interesting results.

(*Please turn to page 118*)

No. 3 12 Die Machine

COMBINATION BLOCK AND SPOOL

MAX. START No. 6 B & S
MIN. FINISH No. 26 B & S



NON-FERROUS EQUIPMENT

Waterbury Farrel Foundry and Machine Company
Waterbury, Connecticut

OFFICES

CLEVELAND CHICAGO PHILADELPHIA

Patenting Temperatures

(*Continued from page 117*)

IN setting forth our opinions relating to the fundamentals of the patenting operation, we have stressed the necessity of getting a homogeneous dispersion of the fragile constituent (cementite) so it would submit to deformation. There is a second possible solution to the problem of homogeneity, namely, the holding of the fragile constituent in solid solution. This ought to produce a material capable of undergoing tremendous deformation without embrittlement. Unfortunately however cold work starts the gamma/alpha transformation, with formation of martensite easily detectable by magnetic tests (K. HONDA, Reports of Tohoku Imp. Univers. XVI, 1917; PORTEVIN and CHEVENARD, Congres de Metallurgie de Liege, June 1930), and this is indicated by an early arrival at a stage beyond which ductility appears to be non-existent.

✦ ✦ ✦

BESIDE the principal factors on which we have dwelt it is quite possible that other phenomena play a part in patenting. It is conceivable that a rapid cooling might, in addition to influencing the internal structure of the grains, exert a favorable influence on the nature of the grain boundaries by suppressing secondary or "micro" segregation. It seems to us that further research in the whole field of patenting is highly desirable, not only in the field of carbon steels with which we are so familiar, but among the other ferrous alloys.

✦ ✦ ✦

Worcester Engineering Society Holds Wire Meeting

ON Thursday, February 7th, the Worcester Engineering Society held its annual Wire Meeting in conjunction with the Worcester section of the American Society for Metals.

✦ ✦ ✦

THIS meeting was held at the Sanford Riley Dormitory of the Worcester Polytechnic Institute and about 150 were present. KENNETH B. LEWIS, consulting wire mill engineer, acted as chairman of the meeting and the speaker was Leroy Seymour, metallurgist for Youngstown Sheet & Tube Co.

✦ ✦ ✦

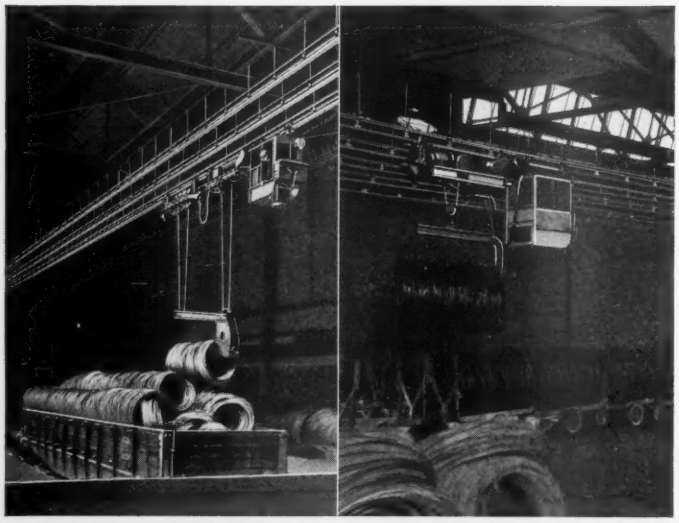
MOVING pictures of the Youngstown wire operations were shown, and were followed by a half-hour talk on heat treatment, particularly in connection with the manufacture of cold heading wire and spring wire. This was followed by a discussion from the floor which lasted about an hour, and the meeting broke up at 10 o'clock.

✦ ✦ ✦

IN the February issue an item reading as follows appeared:

"Ernest Koenig has been appointed chief engineer of the Republic Steel Corporation."

This is erroneous. Mr. Koenig was appointed Chief Engineer of Youngstown District of Republic Steel Corporation. The position of Chief Engineer of the Corporation is already satisfactorily filled.



Are Your Loads 3 POUNDS *OR* TONS?

● Regardless of the weight there is Cleveland Tramrail Equipment suited to your requirements.

Hand Power or Motor Power, at speeds up to 600 FPM, equipment made to operate at just the right speeds to make Cleveland Tramrail the pace-maker for production. Rail and Switch Systems—Cranes—Transfer Bridges—Scales can be built into the system if required.

Complete system from the cooling conveyor or unloading dock to and through the manufacturing processes.

Cleveland Tramrail has that Quality built into it which comes only by Pioneering Experience.

Consult your 'phone directory under Cleveland Tramrail.

CLEVELAND TRAMRAIL

Hand or Electric Overhead Materials Transportation Equipment

CLEVELAND TRAMRAIL

THE CLEVELAND CRANE & ENGINEERING CO.
WICKLIFFE OHIO

Exports and Imports

(*Continued from page 110*)

from Germany, 9,539 square feet from Canada, 1,693 square feet from the Netherlands, and the balance — 506 square feet — from Sweden.

✦ ✦ ✦

IMPORTS of wire fencing and netting galvanized before weaving declined to 139,500 square feet all of which is shown to have come fro mthe Netherlands. Of that galvanized after weaving the 224,500 square feet imported represented a sharp decline from the November trade. Belgium was the principal source of this material with shipments amounting to 220,800 square feet, while the balance came from the Netherlands.

✦ ✦ ✦

THE trade in fourdrinier and other paper making wires declined sharply to only 36,821 square feet—Austria being the source of 29,324 square feet, France of 4,593 square feet, and Sweden of 2,904 square feet.

✦ ✦ ✦

EXPORTS of iron and steel wood screws during December, 1934 totalled 44,833 gross, valued at $4,785. Of this total Cuba took 2,635 gross, valued at $647; Guatemala 3,395 gross valued at $337; Nicaragua 3,005 gross valued at $375; Philippine Islands 2,635 gross valued at $647; Canada 2,385 gross valued at $341; United Kingdom 1,968 gross valued at $252.

✦ ✦ ✦

EXPORTS of brass wood screws during the same period totalled 3,995 gross valued at $1,807. Of this amount United Kingdom took 746 gross valued at $382; Cuba 669 gross valued at $239; Panama 596 gross valued at $287; Peru 360 gross valued at $58; Azores and Madeira Islands 275 gross valued at $90.

✦ ✦ ✦

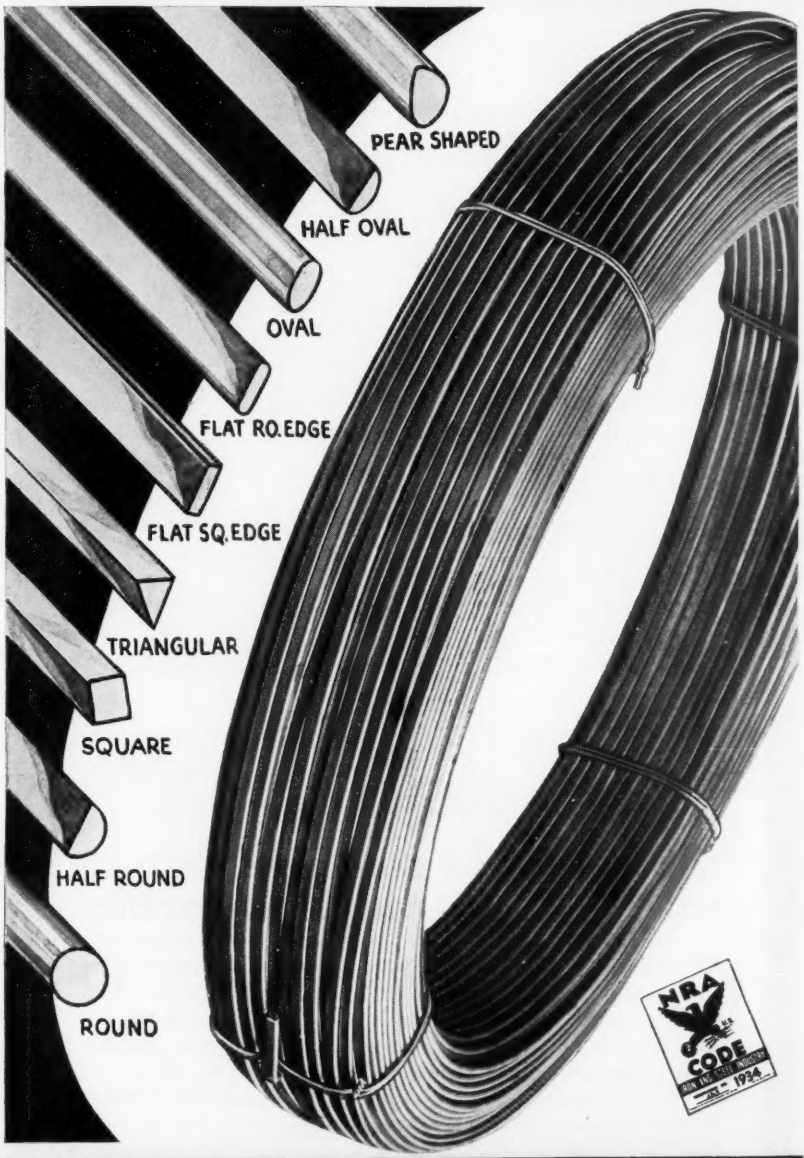
IMPORTS of wood screws during the same period amounted to 10,140 gross valued at $1,116, with Japan supplying 4,680 gross valued at $457 and Sweden 3,660 gross valued at $477.

For All **FABRICATED WIRE PRODUCTS**

CONTINENTAL MANUFACTURER'S WIRE

FURNISHED ANNEALED, PROCESSED AND GALVANIZED

Manufacturers everywhere are rapidly increasing their many uses for CONTINENTAL WIRE. They find it works easily, is constant and uniform in its analysis and is very instrumental in reducing production costs. Continental open hearth steel wire is supplied in standard commercial grades, copper bearing, and "Konik" Metal. "Konik", a new type of steel, contains copper, nickel, and chromium, and possesses unusual properties for case hardening. Our large and experienced metallurgical staff will welcome an opportunity to consult with you regarding your needs — no obligation of course.

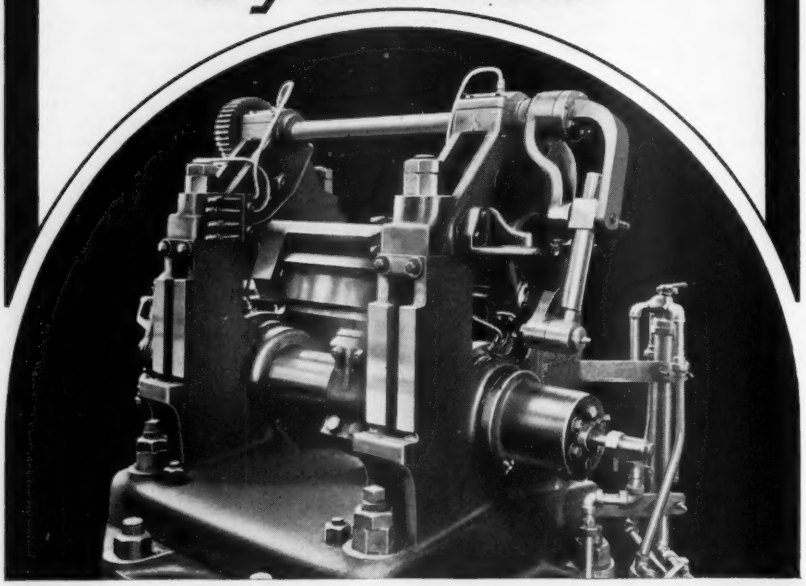


CONTINENTAL STEEL CORPORATION

KOKOMO, INDIANA

Manufacturers of Billets, Rods, Wire, Barbed Wire, Nails; Lawn, Chain-Link, Diamond Mesh, Farm and Poultry Fence; Gates; Black, Galvanized, Galvannealed and Special Coated Sheets; Galvanized Roofing; also "Seal of Quality" Roofing and Kindred Products.

FLYING SHEAR *by LEWIS*



FOR ROD MILLS, BAR MILLS AND STRIP MILLS

Either Steam, Air or Electrically Driven. We will be glad to send you complete data on this thoroughly modern and efficient shear.

LEWIS

LEWIS MAKES A COMPLETE LINE OF ROLLING MILL MACHINERY INCLUDING:

Mill drives up to and including 6,000 HP. Shape Straightener Machines up to and including 24 inch I beam. Motor operated Screw-Down for Mill. High Speed Gear Sets for Continuous Rod Mills. Continuous Bar and Billet Mills. Cold Mills for Sheet and Strip. Rail Breakers. Rail Re-Rolling Mills. Universal Mill Spindles. Chilled Iron and Iron Alloy Rolls for Iron, Steel, Brass, Copper, Aluminum, Zinc and Nickel. For hot Sheets, tin plate and strip—for cold sheets, tin plate and strip. For merchant bars and rods, Shears—Vertical Alligator—Cropping—Plate and Squaring. Special Machinery—Testing Machines and Iron and Steel Castings.

PITTSBURGH, PA.

LEWIS FOUNDRY & MACHINE CO.

Cable Improvements in 1934

ALL types of cable were improved, particularly in insulation and finish.

✦ ✦ ✦

AN investigation into the effect of oxidation on the deterioration of impregnated paper insulation was in progress throughout the year and new information was acquired concerning the effect of such oxidation on cable deterioration in service and methods were devised for minimizing it.

✦ ✦ ✦

A NEW form of cable insulation is paper treated with Pyranol, a material that has the advantages of being nonflammable and nonexplosive—two characteristics which unfortunately are not true of oil. It should go far toward averting the possibility of the manhole fires and explosions which occasionally occur during cable failures in network systems.

✦ ✦ ✦

WHERE a network cable containing absolutely no inflammable material is required, one insulated with Glyptal in combination with Pyranol-treated asbestos is now available.

✦ ✦ ✦

THE use of Glyptal-treated cloth was extended into many fields where resistance to oil, gasoline and acid fumes is required. A development particularly worthy of note is the rayon-motor lead which must resist both acid fumes and oil. Glyptal-cloth insulation with a Glyptal-lacquered asbestos braid is one satisfactory solution of this problem.

✦ ✦ ✦

THE new rubber compounds, namely, Coronal (corona-resisting), Tempernol (heat-resisting), and Aquanol (moisture-reing), were standardized. The Ozonol compound can be used for high voltages or wherever exceptional corona resistance is required. Tempernol is suitable for high-temperature operation, being comparable with varnished cambric in permissible loads and possessing all the inherent advantages of rubber. Aquanol is finding many applications in signal work, submar-

ine work, etc., where moisture resistance is vital.

✦ ✦ ✦

A NEW finish known as Glyptal compound is now available as a jacket material and can be used as an outer sheath whenever rubber cable is required to resist oil, gasoline and acid fumes. It has been applied as a jacket for portable cables, for network cables, for nonmetallic Parkway cables, and for rayon-motor leads.

✦ ✦ ✦

OTHER new types of network cable include moisture-resisting (Aquanol) Performite-insulated cable with a braided finish and an all-rubber network cable which may have either the Aquanol—Performite or the 30 per cent A. S. T. M. Class AO insulation.

✦ ✦ ✦

FOR portable cables a new and relatively inexpensive finish, the loom-weave covering with Glyptal cement was developed for applications where low initial cost is more important than a long life and where oil resistance is desired.

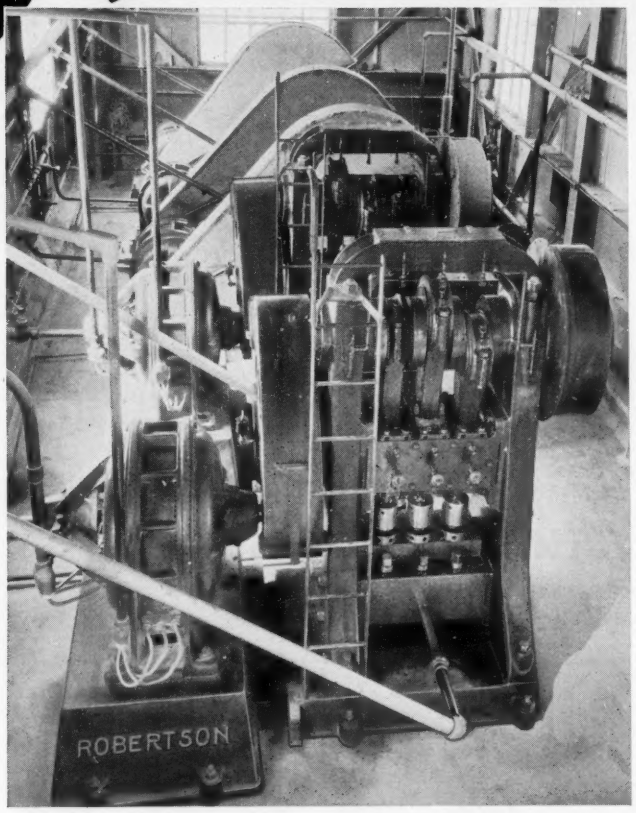
✦ ✦ ✦

A NUMBER of miscellaneous cables was provided to meet special applications. For example, a gas- and oil-burner cable with a lacquer finish; a line wire finished with a high-melting-point compound which gives much better weathering and insulating characteristics than the ordinary weather-proof braid; a Glyptal cloth insulation with a braided finish particularly suitable for low-voltage high-temperature work; and a special rubber-insulated tellurium-compound-jacketed cable furnished with a tinned-steel conductor for low-current applications where considerable mechanical strength is required.

✦ ✦ ✦

IN the problem of lead-sheath uniformity, a process was worked out whereby the oxygen in contact with the lead in the melting pot is consumed by a hydrogen flame prior to the lead extrusion. The hydrogen flame not only serves the purpose of excluding oxygen and preventing oxidation but it also serves as a reducing agent to remove any oxides that may have formed in the lead. This process should go far toward eliminating cable failures.

5 Robertson Hydraulic Pumps



--in one department of this Massachusetts Electrical Cable Plant

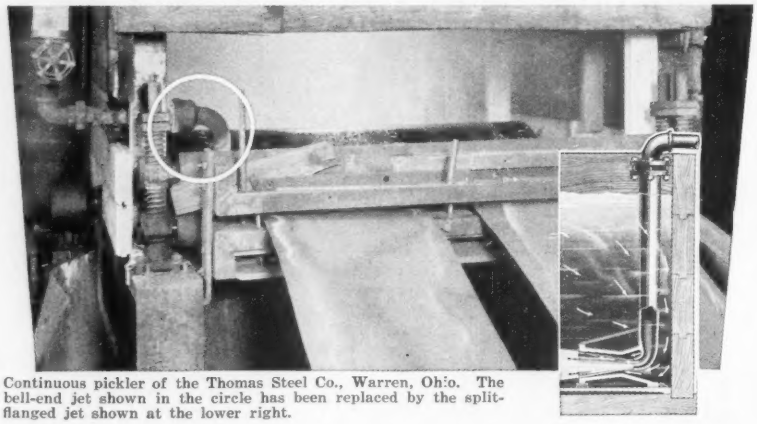
These 5 Robertson high pressure hydraulic pumps operate 4 Robertson lead cable encasing presses in the rubber covered wire department of this large manufacturer of wires and cables. Several more Robertson hydraulic pumps are in their power cable department.

These hydraulic pumps have proved to be efficient and reliable. They are accurately built, sturdy, rugged and low in operating and maintenance cost. There are 16 distinct features of the Robertson Pump that are outstanding. Write for the latest bulletin describing them.

Robertson also makes the following lead encasing equipment for cable manufacturers: Extrusion Presses, Melting Furnaces and Pots, Dies and Cores. Also Lead Sheath Stripping Machines and Hydro-Pneumatic Accumulators.

John ROBERTSON CO. INC. — Pioneers~Since 1858

125-137 Water Street Brooklyn, N. Y.



Continuous pickler of the Thomas Steel Co., Warren, Ohio. The bell-end jet shown in the circle has been replaced by the split-flanged jet shown at the lower right.

That's Where You Find DURIRON

where the acid is active, hot, vicious—where the moving sheet of steel is quickly pickled for the next operation.

The Duriron jet shoots in the steam to keep the pickle liquor at the right temperature. The steam tries to wire-draw it, tear at it, rip it out, but has to give up. The Duriron jet sits smugly in the corner, forcing the steam into circulating, heating, agitating the liquor so that finishing costs will be reduced.

Duriron Steam Jets will do that much for you—and save you money in doing it.

For bulletins, just write

THE DURIRON COMPANY, Inc.

442 N. FINDLAY ST. DAYTON, OHIO

AMERICAN LIME & STONE COMPANY · WARNER COMPANY · MANAGEMENT
Bell-Mine Product

Experienced users say Bell-Mine Pulverized Lime gives a better bond between rod and lubricant in the wire drawing process.

This lime is free from surface dirt or grit and is exceptionally uniform, because it is burned from pure stone that is mined 700 feet under ground.

This lime is shipped in tight steel drums —less carloads; or in drums or in multi-wall strong paper bags—in carloads.

AMERICAN LIME AND STONE CO.

(OPERATING UNDER N. R. A. LIME CODE)

PLANT and EXECUTIVE OFFICE: BELLEFONTE, PA.

Sales Offices: PITTSBURGH PHILADELPHIA NEW YORK CITY

Hydrogen Embrittlement

(*Continued from page 114*)

der the top layer became totally pulverized. This shows that the inhibitor protected the outside only and that hydrogen evolution takes place throughout the center of the rod to such an extent that it was finally pulverized.

✦ ✦ ✦

OF course the inhibiting effect may not have entered into the situation at all. The layer of steel directly under the top surface may have been in the hardest condition; hence it would have been affected first. Although the surface of the rod is usually the hardest due to rolling and would be attacked first according to a statement set forth above.

✦ ✦ ✦

AS the sample was washed considerable hydrogen was seen coming from the inside of the rod through the ends. Mild steel has been known to have absorbed 3 c. c. of hydrogen per c. c. of steel without changing the grain structure so in this particular case the amount absorbed must have been considerably more than this.

✦ ✦ ✦

CONSIDERABLE literature has been written on hydrogen embrittlement and the absorption of hydrogen by steel, but none of it explains the peculiar phenomenon of the "piped" specimen mentioned herein, produced by using a strong inhibitor. It is hoped that in the near future inhibitor manufacturers will make conclusive tests to add more light to this subject.

✦ ✦ ✦

Thomson-Gibb Appoints M. L. Eckman, Head of Research and Development

M. L. ECKMAN, formerly with Federal Machine & Welding Co., has been chosen to head the research and development department of the Thomson-Gibb Electric Welding Co., Lynn, Mass. Mr. Eckman was at one time associated with Ford Motor Co. and has had broad experience with production welding problems. He has spent considerable time in Europe and is regarded as an authority on advanced welding practice in the leading industrial countries.

A New Wire Drawing Device For Use in Combination With Cold Headers

(*Continued from page 107*)

space required for raw stock has been reduced 50 per cent. The cost of drawing the wire as an entirely separate wire drawing operation taking into account building space, investment and additional handling, is estimated at $4 to $5 per ton. A rod of one size is now used for making wire in two or three sizes and instead of carrying 15 sizes of wire in stock, the stock now consists of nine sizes of rods. Formerly wire in 150-ft. coils was used, but these have been replaced by coils of wire rods weighing 350 lbs. so that the stock is started into the header at less than half the former frequency, thus saving time.

✦ ✦ ✦

THE only increase in floor space that is required is about 4 ft. at the front of each header that is taken up by the wire block.

✦ ✦ ✦

Drawing Sizes

WIRE in plain carbon steel is drawn in diameters from 7/32 to 1 in., the size being controlled by the capacity of the header. Drafts are usually held to 0.025 in. to 0.030 in., although a reduction as high as 0.090 in. has been achieved on this wire block.

✦ ✦ ✦

THIS machine is manufactured in standard sizes from No. 0 to No. 4 inclusive, for drawing ¼-in. to 1-in. diameter rods.

✦ ✦ ✦

Summary of Advantages Claimed

1. Reduces Cost of Material

MAKES it possible to produce highest quality cold header products from hot rolled stock instead of cold drawn wire and saves the differential in price of the two materials.

2. Reduces Inventory

WILL draw 15 sizes of wire from 10 sizes of rod, a reduction of inventory tonnage and capital investment.

(*Please turn to page 124*)

SAMSON
Cold Drawn
HIGH CARBON STEEL SPRING WIRE

A Quality Product of Modern Metallurgical Art and Science

Possessing Uniformity in—

Tensile strength for loading capacity
Elasticity and resilience for spring action
Toughness and ductility for knotting and forming

Quality Insured by—

Scientific Control and Inspection through all stages of manufacture from the open hearth department to the shipping department

SAMSON SPRING WIRE
is only one of the many grades of manufacturer's wire made and sold by

KEYSTONE STEEL and WIRE COMPANY

PEORIA ILLINOIS

— DESCO —

A PICKLING STABILIZER ▲ ▲ ▲
FOR CARBON STEELS ▲ ▲ ▲

▲ ▲ ▲

The strong passivating effect of this excellent inhibitor insures a bright finish and forms a sound basis for a bright drawing technique—

▲ ▲ ▲

DELANY CHEMICAL CO.

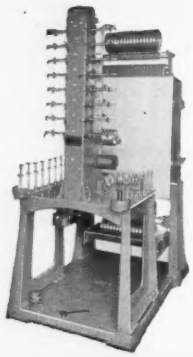
COTTMAN AND MILNOR STS.,
PHILADELPHIA, PA.

Learn about PARALAN

Paralan will give your finished wire and wire products protection from atmospheric corrosion in the mill and in shipping. Paralan-coated wire can be spot welded or soldered without cleaning. Also, Paralan leaves surfaces in good condition for all types of finishes—enameling, japanning, lacquering, plating, etc.

Write for further information. We may be able to solve your difficulties.

AMERICAN LANOLIN CORP.
LAWRENCE, MASSACHUSETTS



AIMCO R-16 MODEL WIRE ENAMELING MACHINE

Enamels Wire 36 B. & S. Gauge and Finer.
Electrically Heated Oven with Thermostatic Control.
Finished Wire Spindles Individually controlled.
Traverse is Adjustable for Different Spool Dimensions.
Low Cost of Enameling Wire is Due to Ease of Operation and Number of Spindles one Operator can tend.
Self-Contained on Bed-Plate.
Motor Driven.
Motor included.

EST. 1855 AIMCO INC. 1915
"American" INSULATING MACHINERY COMPANY
REG. U.S. PAT. OFF.
517 West Huntingdon St.
PHILADELPHIA PENNSYLVANIA U.S.A.

A New Wire Drawing Device for Use With Cold Headers

(*Continued from page 123*)

3. No Additional Power Equipment

OPERATES through a sprocket and chain from the header, does not increase the peak demand on the header motor and requires only an insignificant addition to the power necessary for operating the header.

4. No Additional Labor or Handling

THE coiled rod is handled direct to the heading department and is started through the Wire Drawer and into the header as easily as wire is started direct into the header hence requiring no addition to the crew.

5. Straight Wire Enters Header

AS the drawn wire is not afterwards coiled, it enters the header straight without using a roll straightener.

6. Uniformly Accurate Size on Successive Coils

SINCE successive coils are drawn through the same die there is no variation in diameter from coil to coil as with commercial wire. The drawing dies of tungsten carbide remain true to size for hundreds of tons of product.

7. Perfect, Clean Coating for Extrusion

AS the drawn wire enters the header right after drawing, it is clean and the coating perfect with no chance to pick up foreign matter or deteriorate in transit or in storage from sweating. Furthermore, by changing the lubricating compound the coating can be varied to best suit the job.

8. Heads Easier, Gives Greater Die Life

THE temperature rise during drawing, the perfect coating and the accurate size of the drawn wire all contribute to substantially longer die life, as much as three hundred percent on some difficult, close-limit products.

9. Improves Quality of Product

THESE factors all combine to make it possible to produce carriage bolts with sharply filled out squares and other difficult screws and bolts of highest quality and accuracy, and improve the quality of the ordinary run of cold-headed products.

New Roll Grinder Drive Eliminates Roll Marking

(*Continued from page 96*)

give a range of roll speeds from 11 to 44 R. P. M. The drive is equipped with Timken precision type, anti-friction bearings throughout, including the bearing supporting the large faceplate pulley. The bearings are mounted in adjustable housings and each of the three reductions can be adjusted separately to give the proper tension on the belts without the use of idler pulleys. The bearings are grease packed and will run from six months to a year without replenishment of lubricant. Additional grease, when needed, is applied by a grease gun through readily accessible fittings.

✦ ✦ ✦

AN improved type of flexible faceplate, with balanced, self-equalizing bar equipped with adjustable rubber-bushed driving dogs, compensates for inequalities in roll wabblers and automatically minimizes inaccuracies due to minor errors in setting the roll.

✦ ✦ ✦

THE diameter of the grinding wheel has been increased from 30″ to 36″ so that at the same wheel surface speed the speed of the spindle is reduced, permitting a closer fit of the bearings and at the same time resulting in cooler running bearings.

✦ ✦ ✦

OTHER standard features of Farrel grinders have all been incorporated in this machine, with improvements wherever possible. These include a patented cambering device which produces a mathematically accurate curve for a crowned or concaved roll, exactly symmetrical both sides of the center of the roll; dead center head and footstocks; water-shedding front bed; centralized controls at the operator's station; flood lubricated, inverted "V" ways; flexible steel covers for the carriage ways and drive rack; double helical gear to worm and rack traverse drive; and multiple "V" belt spindle drive.

Lewis Foundry & Machine Co. Reports Improved Business

CONTINUED improvement is reported at the Lewis Foundry & Machine Company, a subsidiary of Blaw-Knox Company, Pittsburgh, according to Frank Cordes, President of the Lewis Company.

✦ ✦ ✦

IN addition to orders previously reported, the company recently booked an order for two additional finishing mills for Ball Brothers Company for their Muncey, Indiana, plant. These mills will be used for rolling zinc sheets. The company has also received an order for a three high mill, complete with tables, from Bethlehem Steel Company, duplicating a mill furnished to this company about a year ago, except that the new mill will be used to manufacture sheet breakdowns up to sixty inches wide.

✦ ✦ ✦

Jagielski Organizes Development Laboratory

THE New Products Development Corp., was recently organized at Yonkers, N. Y., for the purpose of developing, manufacturing and licensing new products and acting as consulting and research engineers for small manufacturers in the wire industry, with the following officers:

President and Treasurer—Otto F. Jagielski.

Vice President and Secretary—William A. Schollmeyer, President of the Schollmeyer Roofing Company, Yonkers, N. Y., former Deputy Public Safety Commissioner of Yonkers, and former Commissioner of Recreation.

General Counsel—Alexander Garnjost, former New York State Assemblyman.

Paul A. Talbot, patent attorney and mechanical engineer.

✦ ✦ ✦

Manufacturers of materials, tools and equipment for wire drawing and forming plants are constantly making improvements and additions to their lines. If you do not find the product or service in which you are interested, additional information will be supplied promptly. Simply address:

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For High or Low Carbon Wire

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Wire, Tube, And Brass Mills
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General Castings for Wire Mill use.
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TRENTON, N. J.

Kenneth B. Lewis
CONSULTING ENGINEER
Wire Mill Equipment, Layout and Practice
17 East 42nd St. New York City
43 Midland St. Worcester, Mass.
Phone: Murray Hill 2-4188
Phone 5-6033

ZINC WIRE
THE PLATT BROS. & CO.
WATERBURY, CONN.

VIANNEY
1869—Joseph Vianney conceives and makes the fire wire drawing diamond die.

Louis G. Beers

LOUIS G. BEERS, formerly Sales Manager of The New Jersey Wire Cloth Company prior to its merging with the John A. Roebling's Sons Company of Trenton, New Jersey, died suddenly at his home from a heart attack on January 31, 1935.

✦ ✦ ✦

HE was 72 years old and was for twenty-eight years with the above company until his retirement in 1928. Mr. Beers' connection with the woven wire fabrics industry was lifelong, and he was considered as one of the country's outstanding personalities in the industry.

✦ ✦ ✦

Walter Mathesius Succeeds G. L. Danforth at South Chicago Plant of Illinois Steel Co.

GEORGE L. DANFORTH, JR., has resigned as general superintendent of works at the South Chicago plant of the Illinois Steel Company, effective February 1st. He is to be succeeded by Walter Mathesius, assistant general manager of works at the plant.

✦ ✦ ✦

MR. Danforth plans to devote all of his time to the affairs of his company, the Open Hearth Combustion Company, 310 South Michigan Avenue. With the H. A. Brassert Company Mr. Danforth organized the Open Hearth Combustion Company in 1923.

HIGH SPEED
Welding Wire Straightening and Cutting Machinery
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FLYING SHEAR
for round and shaped wire.
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TUNGSTEN CARBIDE DIES
For Wire, Rod and Tubing
Round and Special Shapes
TUNGSTEN ELECTRIC CORP.
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Thomson-Judd Wire Machinery Co.
Subsidiary of
Thomson-Gibb Electric Welding Co.
Lynn, Massachusetts.

Wire Drawing Diamond Dies
COCHAUD
WIRE DIE CORPORATION
300 W. 56th ST., NEW YORK
Tel. Col. 5-1340

BUYERS' GUIDE

For more complete information, consult the annual Directory, Index & Buyers' Guide.

ABRASIVES—
Norton Co., Worcester, Mass.

ANNEALING FURNACES
See Furnaces—Various Headings

ANNEALING POTS AND BOXES
Scudder, E. J., Fdry & Machine Co., Trenton, N. J.

ARMORING EQUIPMENT
Amer. Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

BAKERS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

BORON CARBIDE—
Norton Co., Worcester, Mass.

CASTINGS—Wire Mill
E. J. Scudder Foundry & Machine Co., Trenton, N. J.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.
Delany Chemical Co., Tacony Station, Philadelphia, Pa.
Grasseli Chemical Co., Cleveland, O.

CLEANING & PICKLING EQUIPMENT
Broden Construction Co., Cleveland, O.
Duriron Co., The, Dayton, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

COATING—Protective
American Lanolin Corp., Lawrence, Mass.

COILERS—Sheet, Strip and Wire
Borden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
H. J. Ruesch Machine Co., Newark, N. J.

CONDUITS—Iron and Steel
Youngstown Sheet & Tube Co., Youngstown, Ohio.

COPS—Paper
Manning Paper Co., John A., Troy, N. Y.

CRANES—Wire Mill
Cleveland Electric Tramrail Div., of Cleveland Crane & Eng. Co., Cleveland, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

DIES—Diamond
Association of Wire, Rod and Tube Die Mfgrs., Inc., New York, N. Y.
Balloffet Diamond Wire Dies Co., Inc., N. Y. C.
Cochaud Wire Die Co., New York.
Driver-Harris Co., Harrison, N. J.
Kelly Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York.

DIES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Cochaud Wire Die Corp., New York.
Driver-Harris Co., Harrison, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Vianney Wire Die Wks., N. Y.

DIES—Rod and Tube Drawing
Association of Wire, Rod and Tube Die Mfgrs., Inc., New York, N. Y.
Bissett Steel Co., Cleveland, O.
Carboloy Co., Inc., Newark, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Tantalum Carbide
Bissett Steel Co., Cleveland, O.
Kelly Wire Die Corp., New York, N. Y.

DIES—Tungsten Carbide
Bissett Steel Co., Cleveland, O.
Carboloy Co., Inc., Newark, N. J.
Driver-Harris Co., Harrison, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DRAW BENCHES
H. J. Ruesch Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

ENGINEER—Consulting Wire Mill
Lewis, Kenneth B., New York, N. Y.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FILLERS—Paper for Cable
E. W. Twitchell, Inc., Phila., Pa.

FURNACES—Annealing
Electric Furnace Co., Salem, O.

FURNACES—Automatic
Electric Furnace Co., Salem, O.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, O.

FURNACES—Electric
Electric Furnace Co., Salem, O.

FURNACES—Lead Melting
Electric Furnace Co., Salem, O.
John Robertson Co., Brooklyn, N. Y.

FURNACES—Non-Oxidizing
Electric Furnace Co., Salem, O.

FURNACES—Wire, Strip and Sheet
Electric Furnace Co., Salem, O.

GEARS—Wire Mill
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Lewis Foundry & Machine Co., Pittsburgh, Pa.

GRINDERS—Roll
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Norton Co., Worcester, Mass.

HANDLING EQUIPMENT—Material
Cleveland Electric Tramrail, Div. of Cleveland Crane & Eng. Co., Wickliffe, O.

HOISTS—
Cleveland Electric Tramrail Div., of Cleveland Crane & Eng. Co., Cleveland, O.

INHIBITORS
American Chemical Paint Co., Ambler, Pa.
Delany Chemical Co., Tacony Station, Philadelphia, Pa.
Grasseli Chemical Co., Cleveland, O.

INSULATION—Cable or Cable Filler
E. W. Twitchell, Inc., Phila., Pa.

INSULATING PAPER—For Magnet and Enamelled Wire
Manning Paper Co., John A., Troy, N. Y.

LATHES—Die Reaming
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

LIME—Pulverized
Amer. Lime & Stone Co., Bellefonte, Pa.

LUBRICANTS—Wire Drawing
R. H. Miller Co., Homer, N. Y.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
John Robertson Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
New England Butt. Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Thomson-Judd Wire Machinery Co., Lynn, Mass.

MACHINERY—Bunching
Amer. Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Machinery Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Company, Paterson, N. J.

MACHINERY—Chain Making
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Coilers
Broden Const. Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester. Mass.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cold Heading With Wire Drawing Attachment
Ajax Manufacturing Co., Cleveland, O.

MACHINERY—Copper Wire Drawing and Rolling
Farrel-Birmingham Co., Inc., Ansonia, Conn.
H. J. Ruesch Machine Co., Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Cutting
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hallden Machine Co., Thomaston, Conn.
F. B. Shuster Co., New Haven, Conn.
Sleeper & Hartley, Worcester, Mass.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Extruding
John Robertson Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Forming
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Gang Winders
H. J. Ruesch Machine Co., Newark, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Insulating
American Insulating Machinery Co., Phila.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
John Robertson Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
John Robertson Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Measuring Wire & Cable
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Machinery Co., Phila.

MACHINERY—Pointing
Broden Construction Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

BUYERS' GUIDE, Continued

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Morgan Const. Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Lewis F'dry & Machine Co., Pittsburgh, Pa.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Lewis F'dry & Machine Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Rubber Strip Covering
Farrel-Birmingham Co., Inc., Ansonia, Conn.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
Farrel-Birmingham Co., Inc., Ansonia, Conn.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila. Pa.
Broden Construction Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry and Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Machinery Co., Phila.
Fidelity Machine Co., Philadelphia, Pa
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Broden Construction Co., Cleveland, O.
Hallden Machine Co., Thomaston, Conn.
H. J. Ruesch Machine Co., Newark, N. J.
F. B. Shuster, New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Stranding
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Const. Co., Cleveland, O.
Lewis F'dry & Machine Co., Pittsburgh, Pa.
H. J. Ruesch Machine Co., Newark, N. J.

MACHINERY—Swaging
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Worcester, Mass.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Taping
Amer. Insulating Mach. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Tinsel Rolling Mills
Amer. Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
H. J. Ruesch Machine Co., Newark, N. J.

MACHINERY—Welding Wire
Micro Products Co., Chicago, Ill.
F. B. Shuster Co., New Haven, Conn.
Thomson-Judd Wire Machinery Co., Lynn, Mass.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Insulating Machinery Co., Phila.
Broden Const. Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Watson Machine Company, Paterson, N. J.

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila., Pa.

MATERIAL HANDLING EQUIPMENT—
Cleveland Electric Tramrail Div., of Cleveland Crane & Eng. Co., Cleveland, O.

PAPER—Insulating
E. W. Twitchell, Inc., Phila., Pa.

PAPER—Insulation
Manning Paper Co., John A., Troy, N. Y.

PAPER—Packaging (For Wire Cable)
Manning Paper Co., John A., Troy, N. Y.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Delany Chemical Co., Tacony Station, Philadelphia, Pa.
Grasselli Chemical Co., Cleveland, O.

PRESSES—Hydraulic and Mechanical
Farrel-Birmingham Co., Inc., Ansonia, Conn.
John Robertson Co., Brooklyn, N. Y.

POTS—Lead Melting
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead Encasing
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.

PULLERS—Wire
E. J. Scudder Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
John Robertson Co., Brooklyn, N. Y.

REEL AND TENSION STAND—
Sleeper & Hartley, Inc., Worcester, Mass.

REEL CRUTCHES
Watson Machine Co., Paterson, N. J.

REFRACTORIES—High Temperature
Norton Co., Worcester, Mass.

RODS—Wire—Non Ferrous
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.

RODS—Wire—Steel
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Republic Steel Co., Youngstown, O.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

ROLLING MILLS—See Machinery—Rolling Mill

ROLLS—
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Lewis F'dry & Machine Co., Pittsburgh, Pa.

RUST PROOF COMPOUND
American Lanolin Co., Lawrence, Mass.

SHEET—Steel
Republic Steel Co., Youngstown, O.
Superior Sheet Steel Co., Canton, O.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, O.

SOAPS—Wire Drawing
R. H. Miller Co., Homer, N. Y.

STRIP—Brass, Zinc and Non Ferrous
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.

STRIP—Steel
Continental Steel Corp., Kokomo, Ind.
Driver-Harris Co., Harrison, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Republic Steel Co., Youngstown, O.
Wheeling Steel Corp., Wheeling, W. Va.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TREADS—Safety
Norton Co., Worcester, Mass.

TRUCKS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS
H. J. Ruesch Machine Co., Newark, N. J.

VALVES AND FITTINGS—Acid Proof
Duriron Co., The, Dayton, O.

VULCANIZERS
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS
American Insulating Mach'y Co., Phila., Pa.

WIRE—Enameled For Coils
Winsted, Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Continental Steel Co., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Republic Steel Co., Youngstown, O.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, Ohio

WIRE—Nickel Silver and Phosphor Bronze
Hudson Wire Company, Ossining, N. Y.

WIRE—Non Ferrous to Specification
Hudson Wire Co., Ossining, N. Y.
Winsted, Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Spring
Continental Steel Corp., Kokomo, Ind.
Keystone Steel and Wire Co., Peoria, Ill.
Republic Steel Co., Youngstown, O.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Republic Steel Co., Youngstown, O.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE AND STRIP—Brass, Zinc
Platt Bros. & Co., The, Waterbury, Conn.

This is a carefully classified index of concerns who specialize in this industry and who advertise regularly in WIRE & WIRE PRODUCTS. Please mention WIRE when writing to these firms.

THE WATSON MACHINE COMPANY

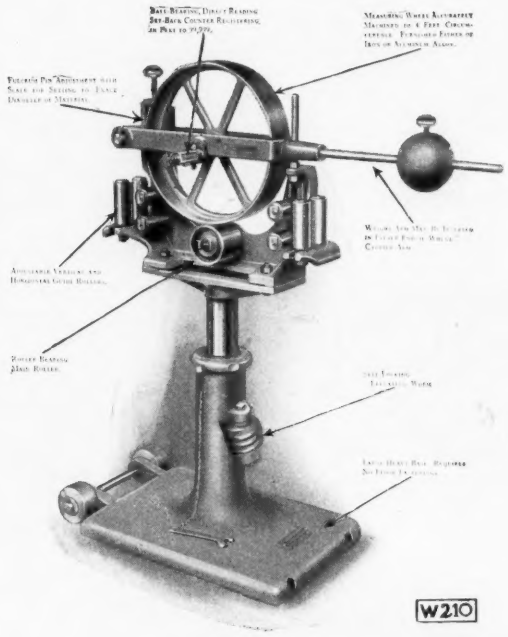
ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

ENGINEERS - FOUNDERS - MACHINISTS

WIRE MEASURING MACHINES

Our Standard for years and still in demand



Made in two sizes: DC-2 for diameters up to 1″, and DC-3 for larger diameters up to 3″.

Three types of Measuring Wheels: Hardened Steel for galvanized and hard surface wires; Semi-steel for bare wire; and Aluminum for covered wire.

Machines furnished without Floor Stands for table mounting.

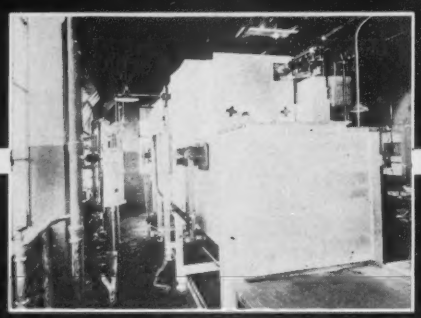
Smaller Measuring Machines, suitable for wires below ½″ diameter, also manufactured—ALL SIZES CARRIED IN STOCK.

Send for bulletin for full details.

ELECTRICAL WIRE AND CABLE—WIRE ROPE AND CORDAGE MACHINERY

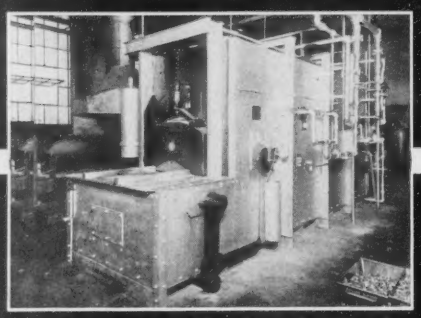
Production Furnaces

We specialize on building production furnaces to fit the customer's particular product, process, plant and production. Below are several furnaces built for handling miscellaneous small and medium size products, such as bolts, nuts, rivets, screws, springs, bearing parts, washers, gears, pinions, etc.



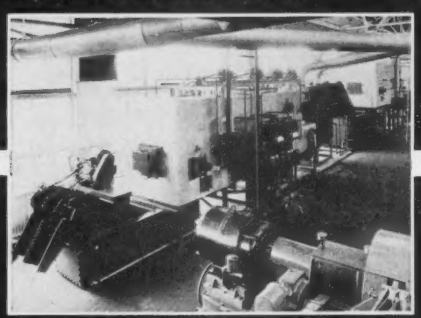
Scale-Free Hardening Furnaces

Continuous conveyor type furnaces with protective atmosphere for hardening with complete absence of scale.



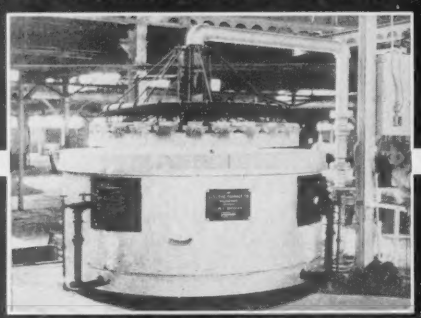
Continuous Chain Belt Furnaces

With long-life, cast link conveyors for hardening, drawing and various other treatments. Over 50 in use.



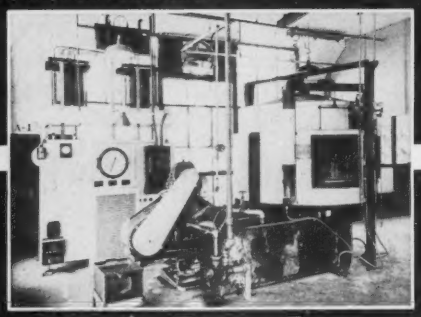
Continuous Heat, Quench, Draw

Without manual labor between - - - completely automatic in operation, temperature and control.



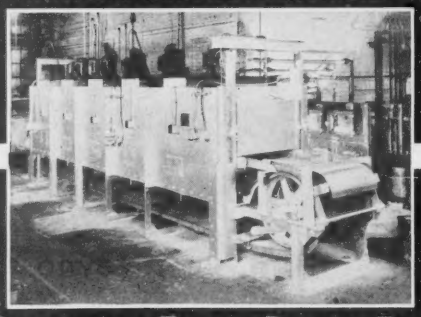
Rotary Type End Heating Furnace

Automatically controlled - - - increased production 100%, lowered costs, replaced four slot-type furnaces.



Rotary Hearth Type Furnaces,

Pan Dumping with Quench—For heat-treating miscellaneous products — also economical on small production runs.



Conveyor Type Draw Furnaces

Intermittently operated, self-unloading, for batch operations or small runs at widely varying temperatures.

We Build the Furnace to Fit Your Job --- For Oil, Gas or Electric Heat

THE ELECTRIC FURNACE CO.

SALEM, OHIO.

FUEL FIRED FURNACES

ELECTRIC FURNACES